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ABSTRACT

This report provides an overview of Singapore's strategy for human resource development and the country's concerted effort to successfully orchestrate the many separate initiatives between 1960s to 1980s into an effective market-driven, three-tiered higher education system emphasizing technology and modernization. The study highlights the pre-eminent role of the government in the planning, funding, and implementation of strategies to achieve an effective, high quality, and sustainable higher education system. The study then outlines the structure of the system (two universities, four polytechnics, and ongoing job training), its diversified institutional development, the growth in student numbers (a seven-fold increase in 30 years), and the reasons for the large numbers of students studying abroad (between 2,000 and 3,000 annually). The report describes the central features of Singapore's higher education: relevance and quality; emphasis on research and postgraduate studies; the service role of the system; the relationship of the state to the system; and the financing of the system. Finally, the study discusses emerging issues in the future direction of Singapore's higher education system and the lessons other developing countries can learn. The appendix presents a brief history of higher education in Pre-Independence Singapore. (Contains 81 references.) (Author/GLR)

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WORLD BANK TECHNICAL PAPER NUMBER 222
ASIA TECHNICAL DEPARTMENT SERIES

Innovations in Higher Education

Singapore at the Competitive Edge

Viswanathan Selvaratnam

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WORLD BANK TECHNICAL PAPER NUMBER 222
ASIA TECHNICAL DEPARTMENT SERIES

Innovations in Higher Education

Singapore at the Competitive Edge

Viswanathan Selvaratnam

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Washington, D.C.

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Foreword

The World Bank has long recognized good quality human resources in developing countries as one of the key ingredients of economic growth and higher levels of living. To achieve this, the Bank since 1963, has assisted developing countries throughout the world to expand and improve educational provisions including higher education.

Singapore too, in the early 1970s, was a recipient of the Bank's assistance for the initial development of the National University of Singapore. Since then, Singapore's higher education has made dramatic strides. Not only has the Republic developed a highly diversified market-driven and flexible higher education system but has successfully matched the high and middle level output of the system to the changing needs of its export-oriented and high-tech driven economy.

The purpose of this paper is to contribute to the ongoing discussion of the role of higher education in economic development and to illustrate, from the experience of a small country devoid of natural resources, how human resources can be mobilized to sustain growth. Singapore's purposeful and consistent higher education policy deserves close scrutiny. With strong state involvement, Singapore has developed a higher education system that both supports and benefits from the nation's export-oriented high technology industries. The review of higher education policy in Singapore from the mid 1960s through the early 1990s holds important lessons for developing countries and for the donor community as to the crucial role and effectiveness of higher education.

Daniel Ritchie
Director
Asia Technical Department

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Abstract

The small island Republic of Singapore has developed a state funded, strongly merit-based education and training system as the key ingredient of its strategy towards higher productivity, economic growth and increased living standards. The study demonstrates the capacity and determination of Singapore, to develop an effective and sustainable vocationally-oriented higher education system as a major resource in absence of any natural resources or domestic market. This high quality human base was used as one of the key incentives' to attract foreign investors to open manufacturing and service facilities in the country. The objective of making available a pool of high-level skilled people for the manufacturing, trading and service sectors was achieved through the state's strong, interventionist policy and implementation strategy. Paradoxically this has resulted in a highly diversified and flexible, market-driven higher education system. This system has linked its form and size, output and quality to the rapidly changing needs of its export-oriented and high technology-driven economy. Singapore's human resource strategy is underscored by the Republic's believe that investment in education, training and skill upgrade are vital in an increasingly high-tech era. Particularly, if the country is to maintain its competitive edge and prosper in a volatile global marketplace. Singapore's good practices and emerging issues has important lessons for small nation states as well as for larger developed and developing countries that have increasingly to depend on a highly competitive global market for their survival in the 1990's and beyond.

Abbreviations and Acronyms

ASEAN	Association of Southeast Asian Nations
CIM	Computer Integrated Manufacturing
CPE	College of Physical Education
CPF	Central Provident Fund
CRC	Clinical Research Centre
CPTE	Council for Professional and Technical Education
EDB	Economic Development Board
ENDEC	Entrepreneurship Development Center
EMI	Export Marketing Institute
FSI	French-Singapore Institute
GCE O	General Certificate of Education (Ordinary)
GCE A	General Certificate of Education (Advanced)
GDP	Gross Domestic Product
GINTIC	Grumman International/Nanyang Technological University Institute
GPC	Government Parliamentary Committee
GSI	German-Singapore Institute
HDB	Housing Development Board
HP	Hewlett-Packard
IBF	Institute of Banking and Finance
IBM	International Business Machines Corporation
ICIS	Information Communication Institute of Singapore
ICL	International Computer Limited
IMCB	Institute of Molecular and Cell Biology
IME	Institute of Micro Electronics
ISS	Institute of System Science
ITE	Institutes of Technical Education
JSTI	Japan-Singapore Technical Institute
MIT	Massachusetts Institute of Technology
NC/P	Ngee Ann College/Polytechnic
NEC	Nippon Electrical Corporation

NIE	National Institute of Education
NITP	National Information Technology Plan
NPB	National Productivity Board
NSTB	National Science and Technology Board
NTI	Nanyang Technological Institute
NTU	Nanyang Technological University
NTUC	National Trade Union Congress
NU	Nanyang University
NUS	National University of Singapore
NWC	National Wage Council
OUDP	Open University Degree Program
PAP	People's Action Party
PDAS	Product Development Assistance Scheme
PEI	Precision Engineering Institute
PGTC	Philips-Government Training Center
PROMSHO	Pre-University cum Overseas Merit Scholarship for Humanities at Oxbridge
RDAS	Research & Development Assistance Scheme
PSC	Public Services Commission
SILAS	Singapore Integrated Library Automated Service
SIM	Singapore Institute of Management
SLF	Student Loan Fund
SMT	Surface Mount Technology
SP	Singapore Polytechnic
SPF	Singapore Police Force
SU	Singapore University
TTC	Teacher's Training College
TTC/IE	Teacher's Training College/Institute of Education
USSU	University of Singapore Students' Union
VITB	Vocational and Industrial Training Board

Executive Summary

Introduction

This study provides an overview of Singapore's strategy for human resource development and the country's concerted effort to successfully orchestrate the many separate initiatives between 1960s to 1980s into an effective market-driven, three-tiered higher education system. It identifies the basic philosophy of Singapore's higher education strategy and the underlying policy rationale. The study highlights the pre-eminent role of the government in the planning, funding and implementation of strategies to achieve an effective, high quality and sustainable higher education system. The study then goes on to outline the structure of the system, its diversified institutional development, the growth in student numbers and the reasons for a constant outflow of students for higher education overseas. It describes and analyses the central features of Singapore's higher education—relevance and quality, research and postgraduate studies, the service role of the system, the relationship of the state to the system and the financing of the system. Finally, the study discusses the emerging issues in the future direction of Singapore's higher education system, the lessons other developing countries can learn from Singapore's success story.

The Rationale

Singapore has the twin disadvantages of being small and devoid of a natural resource base. To overcome these handicaps, Singapore has carried out a well-conceived and phased economic modernization strategy. Initially the strategy was designed to alleviate the high levels of unemployment. In the next phase, Singapore rapidly moved from an entrepôt and import-substitution economy to an open market, export-oriented manufacturing, trading and services center. This was accelerated by foreign investment as the main engine of growth often attracted by the limited government intervention in economy. To achieve this, Singapore recognized that the single most important resource: (i) for its technology-push modernization development strategy; and (ii) for continuing competitive success, was a constantly upgraded and capable upper and middle level workforce. In particular, it was recognized that the demand for more educated workers in manufacturing and service industries would accelerate as technology became more sophisticated. Therefore, since the late 1960s, priority was given to generating an indigenous supply of the requisite manpower, particularly in science and technology, complemented by accounting and business management.

A centrally directed strategy to meet trained manpower needs was adopted and implemented in the period between 1960s and 1980s. The universities, polytechnics and special middle-level job-oriented institutes were called upon to meet the national manpower requirements. The enrollment and graduate output targets up to 1979 were determined by the Government through a rolling five-year manpower budget. Since 1979, the Council for Professional and Technical Education (CPTE), under the Ministry of Trade and Industry became the body responsible for reviewing, planning and projecting the overall middle and high-level manpower requirements of the country. The CPTE uses its Manpower 2000 study, the yearly graduate employment surveys conducted by the tertiary institutions, and labor market signals as a basis for determining the demand and supply for high and middle-level manpower. The projected manpower requirements and the relevance of this manpower to changing needs of the economy are quickly translated into policy measures and transmitted to the various tertiary institutions to form the basis of a varied range of research, education and training programs. The tertiary institutions in turn are expected to achieve the CPTE's targets in response to labor market's needs. Singapore has made major investments in order to give tertiary institutions and their staff the incentives to perform and thus contribute to the country's overall manpower and research goals.

The Structure of the System

Singapore inherited a British model of higher education which was highly elitist. Since 1960, this model has been replaced by a well-structured multi-functional and stratified demand-driven and robust system that has been shaped to meet the diverse manpower needs of the rapidly expanding economy. The basic goal has been to build a pool of Singaporeans with the right knowledge and skills to contribute to national development and not as an end in itself. This resource pool was shaped by the principle that technological and economic performance will depend on both an elite and the broader base of an educated and skilled workforce. To achieve this a three-tiered higher education system was developed.

The first tier is made up of two public universities, the National University of Singapore (NUS) and the Nanyang Technological University (NTU). A third University in the form of an Open University, is being established by the Singapore Institute of Management (SIM) with a one-time financial grant and a donation of some land from the Government. It will begin operating in January 1994 as a private institution. The decision to support a private institution which will operate on a full cost-recovery basis and as a self-financing private institution, is a major policy shift in the provision of higher education by the Singapore Government.

The second tier is made up of four polytechnics: Singapore, Ngee Ann, Temasek and Nanyang. A third tier of middle-level job/career-oriented training institutes has emerged. This tier is made up of the Institutes of Technical Education (ITE) and the joint training centers established by the Singapore Government with foreign Governments/firms as well as a mixture of institutes and centers established by statutory boards, professional groups and private bodies.

The primary function of the first tier is to meet the country's high-level manpower needs including professional requirements, and applied research and consultancy needs of both the public and private sectors. The second tier performs the principal function of providing the country's predominantly technical, management and service skills at the middle-level. The third tier, provides the cutting-edge training programs as well as responding rapidly to changing needs for upgrading and updating existing workers.

In sum, the prime objective is to make the tertiary institutions an effective economic catalyst through excellence and to link their output to the continuously changing needs of the labor market. Public expenditure is used generously and prudently to fuel its expansion and achieve excellence through continuous quality upgrading.

The Access System and Enrollment Expansion

Admission into the tertiary institutions is merit-based and Singapore's leadership jealously guards its erosion in any form. The standards of admission are set at a level comparable to that of the well-established British "red-brick" universities. Thus higher education is rationed through a merit-based and highly competitive system. The contention is that if admission standards are compromised: (i) low ability students would find it difficult to compete effectively during the university course with other better prepared students; (ii) the resulting high drop-out rate would waste scarce resources; (iii) lower-ability students in general would adversely affect the learning of better students; (iv) the graduate degree or diploma would be devalued; (v) poor quality graduates would not have the knowledge or skills to perform well and stay employable particularly in an increasingly technology-driven work place; and (vi) a pool of unemployed graduates would be created. Thus the central goal was to build a need-based pool of Singaporeans with the right-mix of education and skill rather than a supply-driven, and bloated higher education system.

This highly competitive admissions policy did not slow down the dramatic growth in student numbers, which was arrived first and faremost by the market-driven demand for the diverse high and middle-level skills as the country developed rapidly. This enrollment growth was further accelerated by: (a) the democratization of school education; (b) high quality primary and secondary school system; (c) high student subsidies; and (d) the increase in family income, which made higher education affordable to a larger number of middle-class families. The result is that the student population represents today a wide spectrum of Singapore's socio-economic groups.

At the level of the first tier (degree), student numbers increased from 3,502 in 1960 to 9,200 in 1980 and then rose one-and-a half times to 25,307 in 1990, a seven fold increase in 30 years. Correspondingly, at the second tier (diploma), enrollments increased from 4,669 students in 1960 to 13,433 in 1980 and then increased dramatically to 31,265 in 1990, an increase by a factor of six from 1960 to 1990. The increase in student enrollment was markedly skewed towards science and technology, accounting and business management programs. This was in line with Singapore's manpower needs for its push towards high technology-oriented manufacturing, trading and service sectors.

The steady increase in female enrollment is perhaps one of Singapore's most significant achievements. While the gap between male and female tertiary student enrollment has been bridged, there are still imbalances between the sexes in enrollment in professional fields, such as medicine, engineering and law, which are male dominated.

Despite the intense domestic pressure for university places by Singaporeans, Singapore provides between 15 and 17 percent of its university and about 5 to 7 percent of its polytechnic places to foreign students. The policy to have foreign students is to ensure that the tertiary institutions in Singapore do not degenerate into a parochial community. It is also partly used as a vehicle to attract and use regional talents to support and enhance its growing talented manpower and skill needs. In addition, some of the foreign students who return home after their studies in Singapore, are likely to be the future political and business leaders of their respective countries. Therefore, the personal contacts developed between foreign and local students may prove beneficial to Singapore in the long-term.

Overseas Education

Selected top rank universities in the English speaking developed world are used by the Government to train Singapore's brightest students. They are sponsored by the Government through a number of very prestigious and competitive awards. The objective of this is to: (i) expose them to the system, ideas, knowledge and culture of industrialized countries; (ii) equip a core of graduates with informed and coherent thinking on issues of globalization of the economy and the increasingly international competitiveness facing the nation; and (iii) train persons for the second echelon political/administrative leadership positions. The aim is to produce persons with the flexibility of mind and attitude necessary to cope with the new challenges and changes Singapore constantly faces to remain competitive in a global market system.

In addition, the Government and its various statutory boards send students overseas to be trained in specializations which are not available in the local tertiary institutions. The outflow of state sponsored student numbers is further boosted by privately sponsored students as well as a significant and increasing number of self-financing students. The total numbers range between 2,000 and 3,000 annually. It was estimated that in 1990 there were about 15,300 Singapore students studying overseas and 75 percent of them were pursuing first degree-courses. They represent the unment demand created by controlled growth of enrollments in Singapore institutions based on manpower need rather than social demand considerations.

Overseas education has been under some criticism, largely because it has siphoned off, through the various coveted merit scholarships overseas the nation's most highly talented students. This has deprived the local institutions and their student body of full interaction with some of their most capable students. Overseas study has also contributed to a brain drain, and has adversely affected Singapore's ability to meet the rapidly growing demand for manpower in the critical areas of science and technology.

Relevance and Quality

The central role of the tertiary institutions is to provide and advance the scientific, technological and financial-cum-managerial capacity of Singapore's middle and high-level manpower. The use of English as the main medium of instruction was considered to be a pragmatic way to master knowledge, and, in particular, technology, and thus enhance Singapore's competitive edge in the global market.

The improvement of quality and standards is a central goal of all the higher education institutions and every effort is made to translate this into organizational performance at the institutional level. Singapore realized that the only way to achieve a competitive edge in the global market was to have a highly skilled work force that could contribute to the production and export of high quality goods and services cost-effectively. To effectively operationalize quality enhancement Singapore pursues the recruitment of talented higher education staff through a robust local and international recruitment strategy. This is reinforced with: (i) a stringent tenure policy; (ii) rewards for good teaching and research performance with incentives, and recognition; (iii) favorable staff-student ratio accompanied by a well-equipped teaching and research facilities; and (iv) the provision of staff training to upgrade skills and performance.

Research, Postgraduate Studies and University-Industry Links

Research is seen as vital for enhancing the reputation of the universities and maintaining internationally acceptable standards through publications and dissemination. However, currently the research strategy is supported by a national science and technology research policy, which encourages multi-disciplinary research that can contribute towards practical problem solving in real-life and be in line with the country's economic development. Research choices, are prioritized in order to achieve realistic goals and concentrate on incremental technology, beneficial to Singapore's long-term economic development. In this spirit, the universities were requested through the Economic Committee Report of 1986 to accelerate their research and postgraduate training. The main aims were to: (a) foster a more stimulating research environment in the universities; and (b) meet the growing demand for qualified research scientists and engineers.

The Government's R&D policy designed to upgrade the country's technology competency emphasized the university-industry linkage. Within this policy a scheme has been established to actively encourage greater university-industry interaction through consultancy and joint R&D projects. Both universities have established their respective in-house institutes and centers to facilitate university-industry R&D cooperation in addition to providing consultancy services. The polytechnics too offer consultancy services to industry.

This has been further strengthened by the *National Technology Plan 1991*. The plan, in order to accelerate R&D activity, targets to achieve by 1995: (a) the total national expenditure on R&D to reach 2 percent of GDP; (b) the private sector to account for a minimum of 50 percent of this total; and (c) the ratio of the number of scientists and engineers to be 40 percent of the labor force.

To effectively coordinate and facilitate R&D activities, the Singapore Science Council in 1991 was upgraded to a National Science and Technology Board (NSTB), which also overseas the Science Park, with the specific mission to develop Singapore into a center for excellence in selected fields of technology so as to enhance the national competitiveness of Singapore in the industrial and service sectors. The current plan is to develop NSTB into a "one-stop technology center" covering the entire cycle of R&D and focus its goals to promote an industry-driven R&D. The proximity of the Science Park to NUS and NTU has fostered close academic staff interaction and pooling of talent between industrial researchers and industries to undertake joint consultancy and R&D projects. The objective is to create a technopolis with an attractive environment and retain high quality scientific talent.

Government-Institution Relations

As the tertiary institutions are largely state financed, the Government maintains strong control over their policy direction. Through a series of interventionist policies, the Government has curbed university autonomy and in particular has steered the institutions to respond and adapt to the major societal changes and needs. State control, supervision and management over the universities evolved through a series of confrontations between the Government and the universities.

The Government's contention was that academics lacked the aspirations to tackle the national agenda of the day. Therefore, from the Government's perspective there was a need for a central leverage to promote the pivotal role of universities in national development priorities. Government thus saw the need for a nationally managed tertiary system under its direct policy guidance and governed by managerial rather than collegial or academic principles. Within this system, the administration of the tertiary institutions are carried out by administrators. In this state controlled, supervised and management-oriented system the majority of the academics have very little share in decision-making and hardly any influence in academic policy.

Resource Allocation

Since Singapore's long-term economic development is dependent on a critical mass of educated and skilled persons, the Republic has singled out education as a major line item in its public expenditure program. In 1985, the total expenditure on education peaked to 5.1 percent of GDP but declined to just under 4 percent since the recession of 1985-1986. The plan is to raise it to 6 percent of the GDP.

Tertiary education up to 1990, has received a substantial and increasing proportion of the total education budget; its share rose from 13 percent in 1970 to 16 percent in 1980 and to 26 percent in 1990, with a decline in the share allocated to primary education. This increase was kept in line with the increase in student numbers and cost to sustain and enhance quality as well as continue student subsidy. The contention was that the state had to pay top dollars for top quality and student subsidy was essential to promote greater equality of opportunity as well as to attract talent into higher education, particularly into economically critical fields of study. This contrast, with the strategy of several developing countries in the Asia region which expanded their tertiary systems in spite of a decline in resource allocation (in unit terms) and leading to a sharp fall in quality.

However since the recession of the middle-1980s, there has been a cut in the Government's subsidy to students in tertiary institutions and a shift towards greater cost-recovery through higher tuition fees. The eventual objective is to lower the student subsidy to around 70 percent of tuition cost, reduce the over-dependence of public tertiary institutions on Government funding and introduce an activity based funding mechanism. The aim is to provide public funding for tertiary institutions to cover only 60 percent of their operating budget, leaving the institutions to generate the other 40 percent from tuition fees, user charges and other non-governmental sources. The Government would however continue to fund capital expenditure.

This has forced the tertiary institutions, the universities in particular, to diversify their revenue sources. Student tuition fees has increased gradually since 1986 and substantially from 1989. Decision has been taken to increase tuition fees from 1992 between 5 to 7 percent annually to keep pace with wage and other cost increases. In addition, tertiary institutions have been establishing endowment funds by tapping non-Government sources. The two universities with the help of the Government have launched a $1 billion Universities Endowment Fund. The income generated from this fund is to be used exclusively to support special and innovative projects as well as develop programs which will measure intellectual curiosity and research.

Student Loans, Scholarships and Bursaries

Various *ad hoc* loans facilities are available to financially needy students entering publicly funded tertiary institutions locally. However, when tuition fees were increased substantially in 1989, a Tuition Loan Scheme (TLS) was instituted to ensure that no deserving student is deprived of tertiary education because of a lack of financial support.

All students, who are enrolled in a full-time undergraduate program in one of the two universities, irrespective of their parent's income, can borrow up to 65 percent of their tuition fees, while polytechnic students can borrow up to 50 percent of their tuition fees. The loan is interest free during the period of study. However, on graduation the loan is subject to interest averaging the prevailing prime rate charges by the four big banks. One guarantor aged between 21 and 60 years is required and non-Singaporean guarantors are accepted for foreign students.

To be eligible for continued loan installments, a student must achieve satisfactory grades in his/her course work. Loans by university students have to be repaid within a period of 20 years and payment must start not later than two years after graduation, while polytechnic students have to start paying one year after graduation or for male students a year after their national service. If a student emigrates, the loan must be discharged in full before departure and students who drop-out have to repay their outstanding loans immediately. It is too early to assess the social and financial implications of this loan scheme.

The Public Service Commission awards a number of local merit scholarships and bursaries. These awards are to cover a wide spectrum of need-based programs. The awards are highly competitive and are offered to students who show high academic promise and leadership potential.

Lessons, Emerging Issues and the Future of Singapore Higher Education

The rigidly organized and state administered Singapore higher education system, with its effective policies and implementation strategies, has helped Singapore to build a pool of highly qualified Singaporeans with the right-mix of knowledge and training for the country's development needs. This was successfully achieved through prescriptive planning which spelled out in detail the size, shape and kind of higher education system the country would need over the middle and long-term, what would be taught, to whom, to how many and at what cost.

Singapore's strategy has several best practice implications for higher education policy makers in developing nations as well as for higher education experts working in donor agencies. The good practices that can be useful lessons are: (a) the successful and sustained linkage between education, the labor market and economic development; (b) the merit based admission policy; (c) the quest for high quality and the mechanisms used to achieve this; (d) a pragmatic and merit-driven staff recruitment system accompanied by a stringent tenure and reward system; (e) a prioritized development oriented research strategy backed-up by an excellent infrastructure, support facilities and incentives scheme with an aim to achieve excellence; (f) a strategic-management oriented strategy to maintain cost-effectiveness in program offerings and research; and (g) the concerted policy effort to diversify resources and reduce Government subsidy without jeopardizing quality.

In spite of its success, the Singapore higher education system faces a number of emerging issues. The issues are: (a) the ability of a highly state controlled and directed system to respond independently and quickly to the growing education, training and research needs of a rapidly expanding, highly competitive and technologically-driven private sector; (b) the future affordability of higher education by students of lower income families with an annual increase in tuition fees and cost of living; (c) the lag between the country's knowledge based high-technology-driven economy and skill-upgrading through a coherent and flexible continuing education program; (d) the under-representation of female students in professional fields such as medicine, engineering and law; and (e) the growing discontentment with the Government's policy of streaming students in the universities in order to have the right-mix of high quality and talented high-level manpower in critical fields and thus depriving talented students from pursuing their course of first choice.

Singapore has targeted to nurture and reinforce its key human resource capabilities to meet the needs of the country in the future. The vision being to achieve the status and characteristics of a first league developed country within the next 30 to 40 years. Therefore, the objective for tertiary institutions is three-fold: (a) to keep abreast of the growing internalization of Singapore; (b) to make them cater for the fast changing industrial structure; and (c) to maximize the opportunities for those Singaporeans yearning for a higher education. To achieve its objectives and not waste the potential talents of its youth, Singapore proposes to move towards a mass system of higher education by the year 2000, providing 20 percent of each primary one age cohort with a university education and another 40 percent a polytechnic education. In other words, by the year 2000, 60 percent of Singapore's successful secondary school leavers will be able to benefit from a tertiary education.

Conclusion

Singapore's successful higher education system is in many ways unique not because of size and socio-political conditions but it demonstrates the capacity of the small island state to develop a high performing publicly controlled, managed and funded higher education system linked to the country's labor market and economic development. The Singapore experience further demonstrate that for any country that is integrated into a global market system to achieve rapid economic growth it has to be underpinned by a high-tech oriented economic strategy supported by a continuously updated knowledge and upgraded skill base. The Government's strong interventionist policy complemented by an effective implementation strategy has positively helped the higher education system to move away from the traditional British narrow concept of higher education towards a well-structured, multi-functional and stratified labor-market driven tertiary system that meets the diverse manpower needs of a rapidly changing market-driven economy. The central challenge now is to gradually move towards more indirect government interventions as the demands of development as well as the response of tertiary institutions to these demands have become more diverse and complex.

1

Overview

A Success Story

> Singapore today is a young nation, very much in the growth and development phase. Our economy has an insatiable demand for technological and professional manpower. For the present, I do not see any escape from the necessity to gear *tertiary* education to the demand of the market. Much as many may lament the decline of humanistic or liberal education and the ascendancy of professional and technical studies, our priorities do not permit any other course, students want it, society needs it and *higher education* should provide it.[1]

The small island republic of Singapore has a highly developed and effective publicly managed and financed higher education system. Singapore has achieved this system against considerable odds—small size, total absence of natural resources, lack of a domestic market and dependence on a volatile global market economy.

Singapore's success in the last three decades has been underpinned by pragmatic and responsive economic philosophy based on prudent management. Moreover, Singapore's singular commitment to high quality human resource development at all levels as a prerequisite for successful economic growth has been a key ingredient in its economic strategy. Development of a skilled workforce endowed with creativity, high productivity and flexibility to meet the changing skill needs of a capital-intensive economy has been stressed.

To achieve this, the Government not only frames policy directives and generously funds education, but also relentlessly pursues the education and training of each of its citizens to his/her maximum potential in preparation to enter the labor market. This has resulted in the rapid expansion and improvement of the quality of education at all levels. Higher education has been seen to be vital to the goal of providing the right mix of high and middle-level skill needs for the country's growing and competitive manufacture, trade and service activities within the context of increasingly global markets.

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[1] Tony Tan Keng Yam, "University Education and The NUS." *Speeches*, Vol.4(2), 1990, p. 48. (Emphasis added.).

Geography and Demography

Singapore's main island and its 58 islets cover a total land area of only 633 square kilometers. The main island is 42 kilometers long and 23 kilometers wide. It is strategically located at the southern tip of the Malay Peninsula in Southeast Asia and is situated between latitudes 1° 09'N and 1° 29'N and longitudes 103° 38'E and 104° 06'E, approximately 140 kilometers north of the Equator. It is an equatorial country and separated from Peninsular Malaysia by the Straits of Johore and Indonesian islands to the south by the Straits of Singapore. It commands an entrance to the Indian Ocean, the South China Sea and Java Sea, and has long been one of the most important trading centers in the Asia-Pacific region.

In 1990, Singapore had a multi-racial resident[2] population of about 2.7 million with a growth rate of 1.7 percent[3] (Annex 1 - Table A-1). The resident population is made up of ethnic Chinese (77 percent), Malays (14 percent), Indians; (7 percent) and others (1 percent).[4] This has given Singapore considerable cultural diversity. A vigorous population control program in the 1960s and 1970s reduced the annual population growth rate from 2.5 percent in 1965 to 1.5 percent by 1980. The decline in population growth has led the Government in recent years, to once again encourage Singaporeans, primarily through tax and educational incentives, to have larger families. In 1990, the median age of the resident population was 29.8 years. Residents below 15 years of age formed only 23.3 percent of the population, while those 60 years and above constituted 9.2 percent.

Government

Singapore obtained internal self-government from the United Kingdom in 1959. Under the Malaysia Agreement signed between the United Kingdom, the Federation of Malaya (now known as Peninsular Malaysia), North Borneo (now known as Sabah), Sarawak, and Singapore on July 9, 1963, the Federation of Malaysia was formed. Singapore became a member state of the independent Federation on September 8, 1963. Because of irreconcilable political, economic and social conflicts and tensions, Singapore left the Federation on August 9, 1965 to become the independent Republic of Singapore.

Singapore is a parliamentary democracy. Parliament is elected every five years. Voting is compulsory for all Singapore citizens over 21 years of age. Since 1959, the Peoples Action Party (PAP) has been in control of the government of this city-state, with an overwhelming majority in the 81-seat parliament. This has given the country continuous political stability, a strong and competent government and policy consistency.

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[2] Resident population refers only to citizens and permanent residents of Singapore.

[3] The actual 10 year inter-census growth rate has averaged between 1.2 to 1.5 percent. The 1990 figures exclude the non-resident population which makes up 10 percent of the total. This is not included in this growth rate computation.

[4] Department of Statistics, *Census of Population 1990: Advance Data Release*, (Singapore, 1991).

Economy and Employment

In 1990, Singapore's GNP at current market prices was S$64,467 million, and the per capita GNP was S$21,372. The corresponding figures in 1960 were S$2,189 million and S$1,329. Within Asia the per capita income is second only to Japan and the oil-rich state of Brunei. In the last decade Singapore has had an annual growth rate of 8.3 percent in real terms. Growth was 6.7 percent in 1991 and is forecast at between 4 percent and 6 percent in 1992. Overall labor productivity has been growing because of constant skill upgrading. In 1990, Singapore's balance of payments surplus was S$5.3 billion. Its foreign reserves stood at S$56 billion in 1991 with negligible external debt.

In 1970 the country experienced an unemployment rate of 10.1 percent (Annex 2 - Table B-1). However, the rapid economic growth, accompanied by a vigorous employment generation program since independence in 1965, reduced the unemployment rate to 2.5 percent by 1980. Today, Singapore has an unemployment rate of 1.3 percent (Annex 2 - Table B-1) and has moved from a labor surplus to a labor shortage economy. The Economic Planning Committee in its recent report has characterized this situation in the following terms:

> A shortage of workers, whether skilled or unskilled, professional or blue collar, is a chronic and endemic problem in the Singapore economy.[5]

Since 1981, the annually conducted *Graduate Employment Surveys*[6] indicate that more than 90 percent of the university graduates were able to find jobs within six months of graduation, except during the recession of 1985 (83.6 percent) and 1986 (79.8 percent).[7] More than 80 percent of the graduates are employed in jobs relevant to their training. In 1991, the private sector employed seven out of ten fresh graduates, while 96 percent of the employed graduates received their first job offer within six months of completing their final examinations and more than half of them received more than one job offer.[8]

Objectives

This study traces Singapore's strategy and achievements in higher education planning and development within the context of the changing needs of the island state's world market-driven economy. It highlights the basic philosophy on which Singapore's higher education was anchored and the strong role the state has played in the implementation and provision of higher education in response to the significant changes in the country's economy. The focus is on the higher education system and its institutions, with an examination of the goals of these institutions, their expansion and enrollments, the design of curricula and the relevance of the programs to national needs, staffing policy and quality enhancement.

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[5] The Economic Planning Committee, *The Strategic Plan: Towards a Developed Nation*. (Singapore: Ministry of Trade and Industry, 1991), p. 104.

[6] In addition to gathering information on the proportion of graduates who find jobs within six months of their graduation, the survey gathers information on starting salaries, distribution of graduates between the different sectors, proportion of graduates employed in work relevant to their training, and so on.

[7] Soon Teck Wong, "Tertiary Education: The Growing Demand For University Places." *Commentary*, Vol.8, (1&2), September, 1989, p. 40.

[8] *The Straits Times*, October 16, 1992.

In particular, the study examines issues relating to finance, governance, the relationship to the state and to industry, and the future direction of the higher education system. The study demonstrates that the underlying factors which have contributed to this success story are:

(a) A highly centralized, state managed and effective planning machinery.

(b) Efficient implementation strategy.

(c) Generous resource support both monetary and physical.

This was pursued with a quest for quality and relevance and constant monitoring of the mix of the graduate output to the needs of the labor market. Important lessons as well as specific ideas can be learned by acquiring a better understanding of Singapore's good practices and the emerging issues.

Structure of this Study

Section 2 describes how the shift in education towards science and technology was driven by the need to develop an indigenous supply of highly-skilled manpower in order to meet the demands of Singapore's expanding, post-independence, economy. Section 3 describes the structure of higher education in Singapore, its origins in British colonial rule, and its subsequent expansion and transformation in the period since independence. Section 4 deals with the public and private sponsorship of Singapore students studying abroad and the policy towards foreign students studying in Singapore. Section 5 describes the programs offered by the universities, polytechnics and other tertiary institutions in Singapore, pedagogical approaches and standards, staff recruitment and conditions, and the mechanisms for evaluation and assessment that underpin the relevance and quality of this merit-driven system. Section 6 discusses the development of postgraduate studies and research, and the links between the universities and industry. Sections 7 and 8 examine the relationship between the government and higher education in terms of control and financing. Section 9 describes future plans for the expansion of higher education. And finally Section 10 considers the lessons that can be learned from the Singapore model of tertiary education and the future issues the system must contend with.

2

Human Resource Development After Independence

The Rationale

Singapore has the twin disadvantages of being small and devoid of a natural resource base. However, it has the advantages of an ideal geographical location complemented by a natural harbor, an urbanized population and a resilient and adaptable workforce, and a long tradition as a provider of trading and financial services in the region, and business and related entrepreneurial activities.

Shifts in Economic Strategy

To overcome its disadvantages and exploit its advantages, since independence, Singapore has carried out a well-orchestrated, three phase, economic modernization strategy supplemented by a stable political environment and well-developed infrastructure. Since the beginning of the 1990s, Singapore has entered its fourth phase of modernization "to attain the status and characteristics of a first league developed country within the next 30 to 40 years."[9]

The first phase began in 1960, with an emphasis on labor-intensive import-substitution industries to alleviate high unemployment, averaging 9 to 10 percent during the 1960s (Annex 2 - Table B-1). This economic strategy required mainly a small technically skilled and large semi-skilled workforce which was cheap. However, the policies of this strategy led to a small growth in employment and unemployment remained high (Annex 2 - Table B-1).

Continued high unemployment levels combined with rapid population growth and separation from the Federation of Malaysia[10], pushed the Singapore leadership into a second phase of its modernization strategy—the "first industrial revolution." It was initiated in 1969 to transform the economy from an entrepôt and import substitution economy to an open market and export-oriented manufacturing, trade and service center.[11] The basic philosophy was that resource-poor countries with a small domestic market can grow only if they sell abroad.[12] More importantly, it exposed the goods and services produced in Singapore to a highly competitive global market economy. This philosophy was orchestrated by the leadership through an overwhelming reliance on a free market mechanisms and foreign private investment and enterprise as the key engines of growth.

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[9] The Economic Planning Committee, 1991, p. 2.

[10] Garry Rodan, *The Political Economy of Singapore's Industrialization: National State and International Capital*, (Kuala Lumpur, Forum Enterprise, 1991), p. xv.

For the manufacturing, trading and service activities to stay ahead of competitors in a market-driven global economy, Singapore needed to create a comparative advantage—i.e., to nurture and sustain economic activities with a higher value-added content. In other words, to move Singapore out of the "overcrowded, over competitive third league" and "up into the second league of nations."[13] The comparative advantage could be achieved only through constantly upgrading and increasing the productivity of export-oriented manufacturing, trading and service activities through incremental and new technology. This meant that Singapore had to make improvements to existing products and introduce new products, services and processes faster and more effectively than competitors. In short, Singapore had to move from a labor intensive to a capital intensive economic strategy.

To achieve this, the Economic Development Board (EDB) in 1979 ushered in a third phase in the modernization program—a "second industrial revolution," which adopted an aggressive technology-push development strategy.[14] This led Singapore to restructure its economic base towards technology and skill-intensive, low labor content industries and services, including the new high-technology products (microelectronics, computer hardware and software) and service activities (transportation, banking and finance, trade and business services, technical consultancies and telecommunication information services), the growth areas of the future.[15]

Since 1991, the Republic has moved from a single dimensional towards an imaginative multi-dimensional fourth phase in its modernization strategy.[16] Within the next 30 to 40 years:

> The Vision set for Singapore is that of catching up with the First League of Developed Nations, on a moving target basis, by the year 2020-2030 in four key areas:

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[11] Even before launching this strategy, the 1967 Economic expansion incentives (Relief from Income Tax) Act was put in place. It marked the first step towards a comprehensive provision of incentives to export production. Subsequent modifications to this Act were passed to keep in line with changing investment.

[12] "Where Tigers Breed: A Survey of Asia's Emerging Economies." *The Economist*, November 16, 1991, Supplement pp. 1-20.

[13] Garry Radan, 1991. p. 142.

[14] Barry Wilkinson, "Human Resources in Singapore's Second Industrial Revolution," *Industrial Relations Journal*, Vol. 17, Summer, 1986, pp. 99-114.

[15] Vincent F.S. Yip, "The Asian Challenge: A Singapore Perspective," *Technology Companies and Global Markets: Programs, Policies, and Strategies to Accelerate Innovation and Entrepreneurship*, ed. David V. Gibson (Savage, Maryland: Rowman & Littlefield Publishers Inc. 1991), pp. 87-101.

[16] Ibid., p. 38.

(i) Economic dynamism.
(ii) National identity.
(iii) Quality of life.
(iv) The configuration of a global city.[17]

In order to attain this vision, *inter alia*, the key supporting strategies of: (a) skills upgrading and better education; and (b) the contribution of foreign talent, have been singled out as the most important factors vital towards to its achievement as well as to maintain and extend the nation's international competitiveness.[18] In this new phase, according to Mr. Liew Mun Leong, Chief Executive Officer, Singapore Institute of Standards and Industrial Research (SIRIR), Singapore's goal should be

> ... to move beyond manufacturing into more sophisticated business and knowledge-based activities with greater design and innovative content.[19]

The Government's massive investment in infrastructure and accompanied by a vigorous interventionist and targeting policy through "fiscal incentives to high-technology, skill-intensive industries, expanding training programs, and adopting corrective wage policy to encourage the substitution of capital for unskilled labor"[20] paid dividends. These continuing packages of policies which provided the social, political and economic prerequisites, ushered in a golden age of manufacturing-driven growth from the 1970s. From the late 1960s, there was a dramatic rise in foreign (largely multi-nationals) and government investment in the manufacturing sector.[21] This policy was pursued as indigenous capital did not take any serious initiative to actively participate in the manufacturing sector. Government's interventionist policies supplemented by foreign investment spurred the explosion of manufacturing, financial and business service sectors, with employment rising dramatically.[22] By the end of 1972 total unemployment in the country had fallen to 4.7 percent (Annex 2 - Table 2).

The rapid and remarkable state propelled industrialization program not only absorbed the unemployed but also created a critical shortage of skills, particularly at the middle and high-level. Thus, the gap between supply and demand for higher and middle-level skills became more than evident. However, the Government realized that the single most important resource both for its technology-push development and for continuing competitive success was a highly skilled labor force.

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[17] The Economic Planning Committee, 1991, p. 3.

[18] Ibid.

[19] *The Straits Times*, September 4, 1992.

[20] Pang Eng Fong, *Education, Manpower and Development in Singapore*. Singapore: (Singapore University Press, 1982), p.16.

[21] Alwyn Young, "A Tale of Two Cities: Factor Accumulation and Technical Change in Hong Kong and Singapore" in *NBER Macroeconomics Annual 1992*, eds., Olivier J. Blanchard and Stanley Fisher, (Cambridge, MA: The MIT Press, 1992), pp. 21-23.

[22] Ibid., pp. 27-28.

Critical Shortage of High-Level Manpower

The shift in economic strategy—from a predominantly labor intensive trading center towards a sophisticated, high-technology, low labor content and high value added, export-oriented, industrial and service base—necessitated an upgraded middle and high-level skilled and able workforce.

A tightening labor market compounded the skill shortage, resulting in a fall in the supply of the indigenous workforce and a suitably qualified pool of candidates for higher level training (Annex 9). To meet the critical skill shortage, the Government relaxed its immigration employment policy for selective categories of workers. In the first half of 1971, according to a World Bank estimate there were 512 engineers, 365 technicians, 51 accountants, 39 architects and 1,500 administrators and managers working in Singapore on employment passes.[23]

By 1970, the sector employed 120,509 workers and accounted for 20.3 percent of GDP. Table 1 below indicates the projected demand and supply of selected manpower levels between 1970 and 1980. These World Bank projections were based on the assumption that Singapore's annual GNP growth during 1971-80 would be at 13 percent with a corresponding employment rate of 4 percent. In these projections it was also assumed that gross fixed investments would continue to be high, stimulating an annual growth rate of 18 percent in manufacturing output and about 8 percent in employment in the sector. At this projected growth rate the share of the manufacturing sector was expected to be 30 percent of the workforce by 1980.

The multi-national companies, which were uncertain of Singapore's long-term economic viability, naturally did not want to develop their own costly on-the-job and off-the-job education and training systems. At this stage of Singapore's development, and income levels, many families did not have the cash to invest in their children's higher education. Therefore, to attract foreign investment and promote industrialization, the only solution for the government was to take the initiative to meet this growing manpower training demand. In other words, the state had to subsidize the investment in higher education to propel the country's development objectives.

The major part of the manpower to meet these projected requirements was expected to be the output of the local universities and the polytechnics, and through upgrading technicians who had the requisite practical technical experience. Until then the shortages in specialist fields were to be met by expatriates. However, the projected output fell far short of demand, and by the end of 1977, the number of expatriate professionals in various fields continued to rise. There were about 2,500 engineers, 269 accountants, 178 architects and surveyors, and 6,300 managers and administrators. By January 1, 1982, Singapore had 14,767 employment pass holders employed by the various manufacturing multi-nationals, international banks, and business houses.[24]

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[23] World Bank, *Appraisal of An Education Project in Singapore (The University of Singapore).* Restricted Report No. PE-38A (Washington, D.C., 1972), pp. 2-3.

[24] Lee Kuan Yew, "The Search for Talent," *RIHED Bulletin*, Vol. 9 (3), 1982, p. 14.

Table 1. Projected Annual Demand and Supply for Selected Manpower

	Occupation	*Demand (1)*	*Supply (2)*	*Gap (2)-(1)*
1970	Engineers	220	68	-152
	Accountants	125	175	+50
	Architects	25	10	-15
1975	Engineers	330	180	-150
	Accountants	175	180	-5
	Architects	30	35	+5
1980	Engineers	490	365	-125
	Accountants	250	200	-50
	Architects	40	40	0

Notes: Gap *equals* Supply *minus* Demand.
(+) indicates excess supply
(-) indicates excess demand
Source: World Bank: Appraisal of An Education Project in Singapore (The University of Singapore), Washington D.C., (Restricted Report No.PE-38a), January 28, 1972, p. 4.

A Demand-Driven System

Since the late 1960s, priority has been given to developing an indigenous supply of able and high-quality manpower, particularly in science and technology, as they were considered to be the catalyst of economic progress.[25] Therefore, a policy decision was made to tailor the higher education system to meet the needs of industry. This resulted in a shift of higher education and training towards science and technology, complemented by accounting and business management. Several steps were introduced to accomplish this shift.

1. Up to 1979, the Development Division of the Ministry of Finance set the expansion and enrollment targets for tertiary institutions through a rolling five-year manpower budget.

2. Since 1979, and up to the present time, the Council for Professional and Technical Education (CPTE), chaired by the Minister for Trade and Industry, in collaboration with a Manpower Subcommittee, reviews, plans, projects, co-ordinates and implements at the national level the overall medium and long-term middle and high-level manpower needs of the country. In addition, it:

   (i) operates a manpower database;

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[25] Economic Development Board, *Annual Report 1989-90*, (Singapore 1990), p. 93.

(ii) designs information programs on career prospects and future manpower needs; and

(iii) determines the supply facilities and resources for education and training programs.

3. The EDB's Manpower Development Division (now known as Capability Development Division) continuously monitors the training programs and assesses the performance of the graduates at their workplace to ascertain whether the programs are produced in a timely manner and are relevant and adequate to meet industry needs. In addition, it plays a role in specialist manpower training. The EDB's International Manpower Division attracts international talent.

4. To attract, train and retrain skills quickly the National Wages Council (NWC), (a tripartite body comprising government, employer and union representatives, established in 1972), from 1979, formulated and advised the Government to implement a 'corrective' high-wage policy in which were incorporated annual increments and protection against inflation.[26] This 'corrective' and flexible high-wage policy was necessary, reiterated the Minister of Finance in his 1980 Budget Speech, if the country was to be 'developed into a modern industrial economy based on science, technology, skills and knowledge'.[27]

Simultaneously, the EDB introduced a number of incentive schemes to: (a) encourage existing foreign and local industries to innovate and upgrade their technology and skills continuously through investment in new technology, automation, training, and product development activities; and (b) attract new companies from abroad to invest in new high-technology industries and transfer their technology and manufacturing capacity and service activities to Singapore.[28]

The CPTE currently uses its Manpower 2000 study (commissioned in March 1990) and the yearly graduate employment survey of the tertiary institutions as a basis for determining the demand and supply for Singapore's trained high and middle-level manpower up to year 2000. Forecasts and recommendations for the right mix of manpower supply were made at assumed levels of real GDP and productivity growth. In its manpower planning strategy, the CPTE informally involves the private sector. Through this consultative approach it ensures that up-to-date and relevant market signals are taken into consideration for its manpower planning, projections and training initiatives.

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[26] To check inflation, the Central Provident Fund's compulsory contributions of both employees and employers were increased.

[27] Quoted in Garry Rodan, 1991. p. 147.

[28] Under an *Investment Allowance Incentive* an initial tax deduction of up to 50 percent of the value of a new fixed investment for firms producing specialized engineering and technical services, engaged in R&D activities, or involved in mechanizing construction operations. This was supplemented with an *International Consultancy Services Incentive*. All capital equipment can be completely written off in five to ten years and R&D spending can be double deducted, as well as all expenses for export promotion. Corporate taxes were lowered from 40 percent to 33 percent in the late 1980s and Singapore has double taxation agreements with over 20 countries.

According to Mr. Robert Becnell, Far-East Vice-President of Motorola's paging and telepoint systems, Singapore is evolving into a stage where

> ... labor is a very small part of the total cost. The designs are becoming more sophisticated. The manufacturing process is becoming highly automated. The people who need to work in the factory must be of higher and higher educational levels all the time. Technical support must be better.[29]

The projected manpower needs and the relevance of this manpower to the changing needs of the economy are quickly translated into policy measures and transmitted to: (a) universities; (b) polytechnics; and (c) institutions for technical and skilled manpower (VITB[30]/EDB's Technical Institutes) as recommendations to form the basis of a varied range of education and training programs (Table 2). The various institutions in turn are called upon to implement the CPTE's recommendations as well as respond to the changes of the labor market's needs. In other words, it is a top to bottom approach which projects and determines the different types and numbers of graduates, technologists and technicians and skilled workers that are required over a medium to long-term period of time (Table 3).

Table 2. Singapore's Public Sponsored Manpower Training Scheme

1. Graduates	
NUS NTI	Degree and Post-graduate diploma in Education
2. Technologists	
Polytechnics	Diploma
EDB's Institutes of Technology (GSI, FSI)	Diploma
3. Technicians	
ITE	Industrial Technician Certificate (ITC)
EDB's Technical Institute (JSTI)	Certificate in Business Studies (CBS)
4. Skilled Workers	
ITE	National Trade Certificate Grade 2 & 3 (NTC2, NTC3), Certificate in Office Skills (COS), Certificate of Vocational Training (CoVT)
EDB's Technical Institutes (PEI), PGTC)	NTC1, NTC2
Construction Industry Training Centre (CITC)	Builder Certificate, Advanced Builder Certificate

Source: Economic Development Board

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[29] The Financial Times Survey, *Singapore*, London, Monday, June 1, 1992, pp. 1-18.

[30] Now ITE.

Table 3. Singapore's Range of Skilled Work Force

1. Graduates	Professionals
	Other graduates
	Administrators, managers and executives (70% are graduates)
	Graduate teachers
2. Technologists and Technicians	Engineering technicians
	Architectural draughtsmen
	Technologists or technicians
	Computer programmers
	Commercial artists and designers
	Other technicians
	Administrative managers and executives (30% are technologists or technicians)
3. Skilled Workers	Metal/mechanical engineering trades
	Electrical/electronic engineering trades
	Printing and publishing
	Architectural draughtsmen (skilled workers)
	Construction
	Other skilled workers

Source: Economic Development Board

3

The Structure and Development of Higher Education

The education system is British in origin (Appendix I) and is highly structured, stratified and integrated with the national development goals (Annex 7). Figure 1 (Annex 7) and Table 4 below highlight the stratification of the system. As shown in Figure 1, Singapore at present has a 6-4-2-(3) or more school system (six years of primary school, four years of secondary school, two or three years of post-secondary [Junior college] and three or more years of university education).

Education at the primary level is not compulsory. However, since its independence, Singapore has placed a premium on human resource development at all levels to support its industrialization process. This policy was vigorously pursued and was constantly reiterated by the leadership. For example, the former Prime Minister recently emphasized:

> We have to live by our education and our skills. For all the countries, whether you are rich in natural resource, your final position depends on the skills and knowledge of your people.[31]

The development of human resources has been seen as a central policy element in the country's drive towards growth and prosperity. The three levels of the education system are state-managed and financed, and viewed as complementary rather than as competing subsectors.

At the apex is a diversified, demand-driven higher education subsector, which plays the pivotal role of imparting high and middle-level skills and generating the new knowledge and research base necessary to create and adapt technology to meet the demands of society. The top echelons of this subsector are made up of two public universities, the National University of Singapore (NUS) and the Nanyang Technological University (NTU). A third university, in the form of an Open University is being planned for 1994. In a major policy shift, the Government has planned to provide a one time grant to the Singapore Institute of Management (SIM), a private institution, to establish the Open University and operate it.[32]

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[31] *The Sunday Times*, February 9, 1992.

The second tier is made up of four polytechnics: Singapore, Ngee Ann, Temasek and Nanyang. A third tier of high and middle-level job/career-oriented training institutes has emerged, made up of joint training centers with foreign firms and a mixture of institutes and centers established by statutory boards, professional groups and private bodies. This now includes the former Vocational and Technical Institutes, which have been since April 1, 1992, upgraded to post-secondary technical-vocational training institutes and called Institutes of Technical Education (ITE).[33]

Table 4. The Education Pyramid, 1960-90

	1960	*1970*	*1980*	*1990*
Primary	285,537	363,518	291,722	257,932
Percent	80.9	68.9	58.1	48.2
Secondary[a]	57,987	145,740	173,693	191,459
Percent	16.4	27.6	34.6	35.8
Technical & Vocational	1,257	4,727	13,839	29,102
Percent	0.4	0.9	2.8	5.4
Tertiary	8,171	13,683	22,633	56,572
Percent	2.3	2.6	4.5	10.6
Universities	3,502	6,990	9,200	25,307
Percent[b]	(42.9)	(51.1)	(40.6)	(44.7)
Polytechnics	4,669	6,693	13,433	31,265
Percent[b]	(57.1)	(48.9)	(59.4)	(55.3)
Total	352,952	527,668	501,887	535,065

Notes: [a] Includes pre-university enrollment
[b] Percent of tertiary enrollment
Source: Department of Statistics, *Yearbook of Statistics* (various years)

The primary function of the first tier is to meet the country's high-level manpower demand, including professional requirements, and applied research needs. The second tier performs the principal function of providing middle-level personnel with technical, management and service skills.

The tertiary institutions in the first and second tiers come under the direct purview of the Ministry of Education. The third, consisting of a variety of training and professional institutions are supported by both the public and private sectors and is career/workplace oriented and strongly market-driven.

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[32] *The Straits Times*, March 14, 1992.

[33] Vocational and Industrial Training Board, *Upgrading Vocational Training*, (Singapore, 1991), p. viii.

In the third tier, the joint training centers are under the purview of the EDB, while the other centers, institutes, and colleges are under the various statutory boards, professional and private bodies.

The enrollments, course orientation, and output of all state-managed and financed higher education institutions are orchestrated at the national level by the CPTE.[34] In essence, the CPTE (Annex 8) identifies the Republic's high and middle-level manpower priorities, concentrates on achieving them and monitors the critical linkage between its manpower policy priorities, strategies and the economy.

The higher education institutions are required to meet the manpower targets set by the CPTE as well as have the flexibility to respond to changing manpower priorities and the development of marketable skills among the students. The aim is to maximize the utilization of the country's human resources for productive use and avoid graduate mismatch and unemployment.

The Structure and Institutional Diversification

To support a demand-driven and robust system of higher education and training, either the existing institutions and courses (modeled on the colonial system and often obsolete) were restructured and refined or new ones were created. Physical facilities such as high quality classrooms, lecture theaters, tutorial and seminar rooms, laboratories, workshops, libraries, and student/staff housing facilities (student and staff centers, common rooms, sports complexes, residential halls, staff housing, etc.) were expanded to cater for increasing student enrollments and improving the quality of teaching and research. This was reinforced by the recruitment and retention of high quality academic and administrative staff through monetary and non-monetary incentives.

The prime objective was to make the tertiary institutions an effective economic catalyst through excellence and to link their output to the continuously changing needs of the labor market, in particular, the vital manufacturing and service sectors of the nation which needed to innovate and create the maximum value added to its products to sustain and enhance their competitiveness in the global economy. Public expenditure was used to fuel the expansion of the system and to achieve excellence through continuous quality upgrading.

The First Tier—Universities

The University of Singapore did not grow rapidly until the late 1960s. In line with national economic needs, the emphasis of the university was on science and technology. New courses in applied chemistry, fisheries, and biology were introduced, and business administration, sociology, labor and industrial relations, and Malay studies were added. In 1969, to meet the demand for high-level skills of the "first industrial" push, Faculties of Engineering and Architecture and the School of Accountancy and Business Administration were added to the four existing faculties, Arts and Social Sciences, Science, Medicine, and Law.

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[34] CPTE is chaired by the Minister of Trade and Industry and its members are made up of the following: Minister of Education; Senior Minister of State for Education; Permanent Secretary (Labor); Chairman of the Economic Development Board (EDB); Vice-Chancellor, National University of Singapore; President, Nanyang Technological University; and Deputy Secretary-General, National Trade Union Congress (Appendix 3 - Figure 2).

In the seventies, the University of Singapore experienced a steady growth. Enrollments grew from 4,559 in 1969 to 7,030 in 1979, an increase of nearly 70 percent. In the vocationally-oriented Faculties of Engineering and Business Administration, enrollment grew more than anticipated, largely due to the rapid growth of the industrial and service sectors.

The Singapore Government gave full recognition to degrees of Nanyang University in 1968. However, the academic quality and the employability of graduates compared with those of the University of Singapore were markedly lower. The Nanyang University admitted all applicants irrespective of their academic attainments and awarded them a pass degree after three years of study if they obtained a total of 108 credits. Students with outstanding grades could stay for a fourth year for an honors degree.

However, there was very little quality control.[35] The 1959 *Prescott Commission* and the 1960 *Nanyang University Review Committee*,[36] which reviewed Nanyang University's overall standards, found that its method of organization and administration along with its low quality of academic staff were not consistent with those of a modern university. A subsequent Curriculum Review Committee, set up in 1965, was severely critical of the University's curriculum, standards, and medium of instruction.[37]

The Committee made major recommendations for changes in the curriculum and a shift to bilingualism with English (the main working language of Singapore) and Mandarin as the main media of instruction. In spite of these efforts to reform Nanyang University from within, the University was "ending up with the weakest students, and even smaller numbers."[38]

Tension mounted between the Chinese and English-educated in the market place as the economic and career prospects of the Nanyang graduates began to dwindle. It was apparent that Nanyang University, and particularly its graduates, could not "survive the test of the market."[39] As the Minister of Education observed in 1980,

> The question of what students should learn and what professors should teach cannot be divorced from the larger question of the role of the university in the society which pays its bills and from which it draws its students.[40]

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[35] Lucian W. Pye and Arthur L. Singer, Jr., "Higher Education and Politics in Singapore," *Minerva*, Vol. 2(4), 1964, pp. 537-538.

[36] *Report of the Nanyang University Review Committee* (1960) (Singapore: Government Printers, 1961).

[37] *Report of the Nanyang University Curriculum Review Committee* (Singapore, 1965).

[38] Lee Kuan Yew, "Three Options for Nanyang University," *Speeches*, Vol. 3(10), 1980, p. 1.

[39] Lee Kuan Yew, "NUS: Practical Realities," *Speeches*, Vol. 3(2), 1980, p. 2.

[40] Tony Tan Keng Yam, 1990, p. 48.

Consequently, reforms were imposed from outside. The Government "persuaded" the Nanyang University Council to accept unanimously the Prime Minister's proposal to merge the Nanyang University with the University of Singapore in August 1980 to form the National University of Singapore (NUS). The merger was in accordance with the recommendations of the Sir Frederick Dainton's Report on *University Education in Singapore of 1979*, in which he stressed the need for Singapore to have a single strong national university.

To meet the anticipated high quality skilled manpower demand, the Government, on the recommendation of CPTE, took far reaching measures to expand engineering and technology training facilities at all levels.

Instead of expanding the Faculty of Engineering at NUS, in 1981, the Nanyang Technological Institute (NTI) was established as a separate engineering institute on the former campus of the Nanyang University. The Institute began with three schools: (i) Mechanical and Production Engineering; (ii) Civil and Structural Engineering; and (iii) Electrical and Electronic Engineering. Later, two more Schools were added: (i) Applied Science; and (ii) Accounting and Business.

NTI was to produce the "highly skilled manpower needed for the sophisticated, capital-intensive, high value added industries that will figure predominantly in Singapore's economy in the 1990s."[41] The main role of NTI was to train practice-oriented engineers to complement the output of the more academically-biased engineers of NUS; the latter were better suited for research and development and corporate management than to fulfilling the demand for skills in the rapidly growing industrial sector. In the academic year 1987-88, the School of Accountancy of NUS moved to NTI to complement its engineering orientation.

Administratively and financially, NTI was autonomous; in academic matters, however, it functioned as an integral part of NUS. The graduates of NTI were awarded NUS degrees, and from its inception in 1981 through 1991, NTI produced 7,200 Accountancy and Engineering graduates.

In July 1991, in accordance with the recommendation of the Dainton Report of 1989,[42] NTI was made a full-fledged university and named the Nanyang Technological University (NTU). The Institute of Education and the College of Physical Education were merged into a single National Institute of Education (NIE) and incorporated as a component of NTU. In 1992, NTU began awarding its own degrees.

The overall aim for NTU is to develop it into a comprehensive university with general academic excellence and niches of international eminence. As a comprehensive university, it is to offer courses from a wide variety of disciplines and break away from the mould of NTI, which offered only technology related courses.[43] In addition, it is encouraged to compete with NUS.

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[41] Molly Chan, "Report on Tertiary Education in Singapore," *RIHED Bulletin*, Vol. 10(1), (January-March 1983), p. 5.

[42] Lord Dainton, *Higher Education in Singapore* (Singapore, November 2, 1989).

The structure of NTU is an American-British hybrid in that the American university credit-hour system has been incorporated into a prescribed core curriculum. The philosophy behind this move is "for NTU to offer tertiary education on the cutting edge areas of business studies, hotel management and communication studies."[44] In 1992, it added two new vocationally oriented Schools—Hotel Administration and Communications. Beyond 1993, there are plans to add two more Schools: (i) Fine Arts and Design; and (ii) Architecture—and other areas considered important to Singapore.

The Government's long-term policy assumes that, as Singapore develops, it will need not only engineers, doctors and skilled administrators but also writers, artists, and musicians to enrich cultural life. In order to maintain vigor and progress in university education, the two universities will develop into comprehensive universities and be encouraged to compete and offer as many courses as required at their respective campuses. Each university is encouraged to develop its own potential and establish a niche in regional, national, and international academic arenas in relation to its teaching and research. It is envisaged that competition between them will stimulate creativity as well as force the two universities to meet student and national needs.

The Open University, which is planned to be established in January 1994 as a private sector institution under the management of SIM, will offer courses "which are assessed to have a market demand." The three joint first degree courses with the Open University (UK) are to be English language and literature (BA), mathematics (BSc), and computer science (BSc).[45] Admissions would not be based on a completely open system. Instead students at entry would be required to have some minimum qualifications, in order to ensure that they have a reasonable chance of getting their degree. Candidates who successfully complete these courses will be awarded a British Open University degree. These courses are expected to enhance Singapore's manpower development as well as the personal development and the job prospects of the students. The government is expected to initially assist SIM with a one-time capital and development grant of S$38 million including the lease of a sizeable piece of land in its establishment[46] and play a regulatory role to ensure its degrees are of a high quality. In line with this policy, the Open University Degree Program (OUDP) Steering Committee has been set up under the chairmanship of the Senior Minister of State for Education. This government minister-chaired committee will determine the academic content and standards of the degree programs and recruit and supervise tutors on the delivery of courses. In addition, the OUDP Steering Committee will liaise with the British Open University on the development of new courses, as well as modifications to courses to suit the Republic's needs.[47] The SIM's tie-up with the British Open University is for an initial five-year period.

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[43] Committee on NTU Future Directions, *Future Directions for the Nanyang Technological University* (Singapore, February, 1991), p. 1.

[44] Ibid., p. 3.

[45] *The Straits Times*, July 31, 1992.

[46] "SIM to run Open University Degree Programs", *Management News* (a newsletter of Singapore Institute of Management), July/August 1992, p. 20.

In sum, the Government's prime objective is to see that:

> ... universities will be in tune with the times keeping an ear on what society expects of graduates and adapting their degree programs. University lecturers will be cognizant with teaching methods. They will fulfill the university's mission to inspire and challenge the nation's finest minds .... Tutors will develop not only the creative abilities of their students but also the entrepreneurial spirit and the drive to broaden their needs and extend their vision. [48]

The Second Tier—Polytechnics

The main goal of the polytechnics is to meet the rapidly growing requirements for middle-level technical manpower in the various relevant fields. To this end, four polytechnic institutions have been established to date. In 1963, the Singapore Polytechnic was restructured and upgraded to the status of an advanced college of technology. Its craft courses were transferred to the vocational and technical institutes. A second independent technical institution, called the Ngee Ann College, was set up in 1963 by the Ngee Ann Kongsi (Association) for Chinese-educated secondary school graduates to acquire a vocationally-oriented post-secondary education. The motive of the founders was to match graduate output with the industrial and commercial needs of the country. The college became a public institution in 1967, and was upgraded in 1982 to a polytechnic. A third polytechnic, the Temasek Polytechnic, was established in 1990 to complement existing programs as well as broaden course options. A fourth institution, the Nanyang Polytechnic, was established in July 1992, pioneering health sciences education with an initial enrollment of 700. This institution is expected to establish a niche for itself in para-medical technology.[49]

In April 1973, the Teacher's Training College (TTC) was upgraded to an Institute of Education (IE) with responsibility for all teacher training and research in education. It had provisions for suitably qualified students to enroll in the University of Singapore for Diploma, Master's, and Doctorate courses in education. A College of Physical Education (CPE) was established in July 1984, to train specialist teachers of physical education for primary and secondary schools and Junior Colleges. As indicated earlier, IE and CPE were amalgamated into the NIE and incorporated into NTU.

The Third Tier—Other Centers of Public and Private Training

The Vocational and Industrial Training Board (VITB) institutes were upgraded to post-secondary Institutes of Technical Education (ITE) to better meet the needs of the secondary school graduates and the economy (Annex 7). The new upgraded system, consisting of seven ITE will in the future enable secondary school graduates with 10 years of schooling to obtain higher-level skills, wider options, and more opportunities for progression to further education and training.[50]

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[47] *The Straits Times*, October 21, 1992.

[48] Government of Singapore, *Singapore: The Next Lap* (Singapore: Times Edition Pte Ltd., 1991), p. 48.

[49] *The Sunday Times*, November 24, 1991.

The EDB, under a co-operative and jointly run training scheme with foreign governments and firms, established technical manpower development institutes. They are the: (a) German-Singapore Institute (GSI), (b) French-Singapore Institute (FSI), (c) Japan-Singapore Technical Institute (JSTI), (d) Precision Engineering Institute (PEI), (e) Philips-Government Training Center (PGTC), (f) Information Communication Institute of Singapore (ICIS) at the Telecoms,[51] (h) Matsushita-EDB Surface Mount Technology (SMT) Unit and the National Productivity Board (NPB).[52] These institutions are demand-driven and their training takes place within a simulated factory environment. They are thus targeted to meet particular labor market niches at the diploma and certificate level in electronics, factory automation, advanced manufacturing technology, and mechatronics. To streamline and further boost technical education at the national level, the FSI, GSI, and JSTI, which are diploma awarding institutes, have been brought under the management of the new Nanyang Polytechnic. In addition, they will form the core of the Polytechnic's engineering program.[53] The PEI and PGTC which train craftsmen and technicians at the certificate level are now managed by the ITE.[54]

Professional groups have established several institutes in addition to SIM, among them the Institute of Banking and Finance (IBF), the Marketing Institute of Singapore (MIS), and the Export Marketing Institute (EMI). These are independent, non-profit and self-financing institutions whose goals are to develop skills in their respective fields in order to enhance the career advancement of their members.

In particular, SIM has expanded its programs rapidly, and had a total of about 8,000 enrolled in certified programs and in addition about 6,000 students attended short courses and seminars in 1991.[55] SIM offers six Master's and two Bachelor's Degree programs and 15 Diploma and Certificate courses in business and management related fields. The Master's programs in Business Management and Finance are offered through twinning arrangements with Brunel/Henley[56], United Kingdom (50 students), Royal Melbourne Institute of Technology (27) and Monash University (beginning 1993) in Australia, and George Washington University (23) and Rutgers University (16) in the United States of America. In 1992, a Ph.D program in Business Administration was launched in conjunction with Brunel University in the United Kingdom.

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[50] Vocational and Industrial Board, *Upgrading Vocational Training*, (Singapore, 1991), p. 2.

[51] A collaboration between Singapore Telecoms and AT&T.

[52] To train SMT technicians and engineers.

[53] *The Straits Times*, November 13, 1992.

[54] Ibid.

[55] Singapore Institute of Management, *Annual Report 1991*, p. 45.

[56] Brunel/Henley - a joint program of University of Brunel and Henley Management College in the U.K.

Two non-profit, private Art and Design Colleges, the La Salle and the Nanyang Academy of Fine Arts, provide a variety of art and music programs. Together these institutions have a total enrollment of about 500 students.

Enrollment

Singapore's first and second tier tertiary institutions cater predominantly for direct entry of Junior College (post-secondary) and secondary school-graduates. However, entry into the higher education institutions is not automatic for those who have completed their "A" or "O" levels. The system of entry is changing with the increasing demand-driven skill requirements of the high-technology driven economy of Singapore.

The shift towards high-technology driven manufacturing and service sectors does make a compelling case for continuing life-long education. Publicly funded institutions \are increasingly catering for adult learners, giving a second chance to those entering the university for the first time, as well as a chance to those adults seeking some form of formal continuing education which is related to their career and workplace. Thus far this process does not appear to be either well-structured nor keeping pace with the rapid growth of Singapore's high-technology driven economy when compared to Hong Kong (Annex 3 - Table C-1). However, in the country's new Strategic Economic Plan, one of the major aims is to give:

> ... maximum opportunity and encouragement for everyone in the workforce to upgrade their skills and knowledge during their entire career.[57]

Growth

The highly competitive and selective admission policy has not unduly impeded the development and expansion of the tertiary system in general. There has been a dramatic growth in student numbers, physical facilities, and support services. The prime rationale being:

> ... if the demand for workers with particular levels of educational attainment is not met, shortage of such personnel will create bottlenecks in production and retard economic growth. Conversely, an oversupply of workers of a particular level of educational attainment may lower the average wage and even reduce the chances of gainful employment.[58]

Apart from the rise in enrollment due to a market-driven demand, the impetus to the growth in student numbers has also come from a number of supporting factors: (a) increased social egalitarianism; (b) the democratization of school education; (c) high-quality primary and secondary school system; (d) high student subsidies; and (e) the increase in family income, which has made higher education affordable to a larger number of middle-class families. In the absence of hard data on the relationship between school attendance and family income, it is difficult to conclusively show the share of students in higher education from the lowest socio-economic quintile. Available data show that tertiary students in the last two decades have come from a much wider spectrum of Singapore's socio-economic groups (Table 5), indicating an increase in tertiary educational opportunities for economically disadvantaged and for first generation students. In other words, higher education has given rise to the emergence of elites among lower-classes. However, the findings in Table 5 have to be viewed with some degree of caution. It is very likely that children of families of higher income groups (who may be represented by those owning private houses) may have been sent abroad.

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[57] The Economic Planning Committee, 1991, p. 55.

[58] Ng Siew Fong, *Returns to Investment in Education in Singapore*, (M.Ed Dissertation, National University of Singapore, 1987), p. 4.

Table 5. Background of Tertiary Students, 1990
(percent)

	University	*Polytechnic*	*General Population*
Housing Development Board (HDB) flats			
- 1 & 2-room	2	3	7
- 3-room	30	41	36
- 4-room	21	29	27
- 5-room & executive	20	14	15
Private houses and flats	23	9	11
Others	4	4	4

Source: The Straits Times, January 16, 1992.

The proportion of students entering the university to the primary school cohort increased by a factor of more than three between 1978 and 1991 (Table 6). This expansion took place at the second tier as well. The growth in enrollment was particularly sharp in the last decade (Figure 1). Overall student enrollments increased from 8,171 in 1960 to 13,683 in 1970 and 56,422 by 1990, a six-fold increase from 1960 to 1990 (Annex 4 - Table D-1).

At the degree level, which includes postgraduate students, student enrollments increased from 3,502 in 1960 to 9,200 in 1980 and then jumped to 25,307 in 1990 (Annex 4 - Table D-1), a seven-fold increase. At the diploma level, enrollments increased from 4,669 students in 1960 to 13,433 in 1980 and then increased rapidly to 31,265 in 1990—an increase by a factor of six from 1960 to 1990 (Annex 4 - Table D-1). The increase in enrollment has been markedly in favor of courses in science and technology as well as accounting and business management because more of such courses were offered.

The overwhelming number of students in the first tier are enrolled in the NUS, which had 18,342 students in 1990, or 33 percent of the tertiary level enrollment (Table 7 and Annex 4 - Table D-1). The aim was to provide accommodation for as many students as possible; however, because of an acute shortage of student housing, only about one-third of the NUS students are accommodated in university residential halls.

Table 6. Percentage of Age Cohort Admitted to University
(random years)

Year	*Number*	*Percent of Cohort*
1960	1,641	2
1978	2,223	4
1983	3,478	6
1988	5,586	13
1991	5,657	15

Source: *The Straits Times*, August 15, 1988 and The Sunday Times, October 27, 1991.

Table 7. Distribution of Tertiary Enrollment
(percent)

Institution	*1960*	*1970*	*1980*	*1990*
First Tier				
SU and NUS	20	34	41	33
NU	23	17	na	na
NTI	-	-	-	12
Sub-total	43	51	41	45
Second Tier				
SP	29	30	37	27
NC/P	na	4	13	23
TTC/IE	28	15	10	3
CPE	na	na	na	0.3
Sub-total	57	49	59	55

Source: Department of Statistics, *Yearbook of Statistics*, (various years).

In 1990, NTI had 6,965 students, 12 percent of tertiary level enrollment (Table 7), of whom approximately two-thirds lived in residence halls. NTU, in its first academic session of 1991/92, increased its student enrollment to 9,800, which includes the students from NIE.

The total enrollment in the second tier may grow much faster with the establishment of a fourth polytechnic in 1992 and possibly a fifth by 1995. However, in percentage terms, it slightly declined from 57 percent to 55 percent between 1960 and 1990 (Table 7). The annual overall higher education age cohort participation rate increased from 4 percent in 1960 to 9 percent in 1975 and 35 percent in 1991, while the university participation rate increased from 2 percent in 1960 to 15 percent in 1991

(Table 6).[59] The total undergraduate enrollment in the two universities currently stands around 23,000.[60]

In absolute terms (on the arithmetic scale - Figure 1), polytechnic enrollment has exceeded university enrollment, with the gap widening over the 1980-90 period and expected to widen even more beyond 1990. In relative terms (log scale - Figure 2) both enrollments have kept pace with each other, with the gap being almost constant. However, polytechnic entrants have exceeded university entrants, since those students with "A" levels who were not admitted into NUS and NTI or those not taking up studies overseas are generally encouraged to enter polytechnics. The prospects of polytechnic graduates have improved in terms of conditions and salaries over the last two decades, mainly attributable to effective labor demand for middle-level skills.

Female Enrollment

The overall steady increase in female enrollment and share of total enrollment at both levels of the tertiary system is perhaps the most significant change. The numbers increased from 2,061 (25 percent of all male and female students) in 1960 to 22,885 (41 percent) in 1990 (Annex 4 - Table D-1). Female students in 1990 constituted 45 percent of the first tier and 55 percent of the second tier. The increase in female participation rate in higher education is due to (a) the changing of traditional attitudes towards education and work for women, (b) the necessity to have a joint husband/wife income with rising standards of living, and (c) the expanding job opportunities for women in high-level occupations.

The female majority in the second tier was due mainly to high female enrollment in the former Institute of Education (now NIE) (teacher training). The increase in female student composition is in line with Singapore's policy to increase its indigenous workforce by increasing the rate of female participation in the labor force to 50 percent by 1995.[61]

While the gap between male and female tertiary student enrollment has been bridged, there are still imbalances between the sexes in enrollment in male dominated professional fields such as medicine, engineering and law. At the two universities, there was a disproportionate enrollment of male students in the highly competitive, hard science-oriented programs of medicine, engineering and computer science. For example, out of 3,538 engineering students at NTU, only 607 were females (17 percent). However, this disproportional ratio was not the case in programs such as architecture, business administration, and accountancy. What's more, female students dominate the arts and social science programs, except in economics. The polytechnics, by contrast, are firmly male dominated.[62]

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[59] *The Sunday Times*, October 27, 1991.

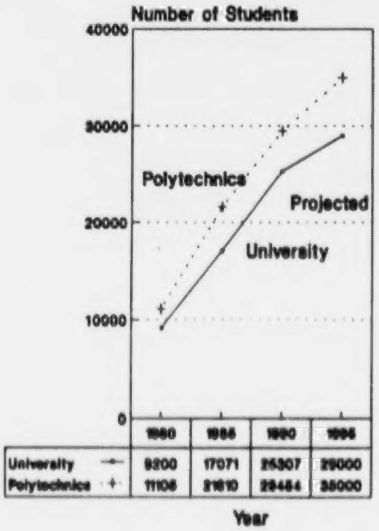
[60] *The Strait Times*, February 2, 1993.

[61] Report of The Economic Committee, *The Singapore Economy: New Directions* (Singapore: Ministry of Trade and Industry, 1986), p. 106.

However, there is no overt policy or action to correct these imbalances between the sexes. Perhaps the root cause for these imbalances lies in: (a) the differences in academic preparation in schools between males and females; and (b) the fact that women have been leaving the workforce after becoming wives and mothers. Unless Singapore takes a positive policy measure to give greater scope to female students to shift towards science and mathematics in schools, enrollments in engineering, medicine and computer science will continue to be male dominated. Only through affirmative action will women be able to move into the higher level and better paying professional jobs in substantial numbers in the future.

Figure 1. Enrollment Growth in Tertiary Institutions

Arithmetic Chart



Source: Singapore: The Next Lap. Times Editions Ltd. 1991, and Author.

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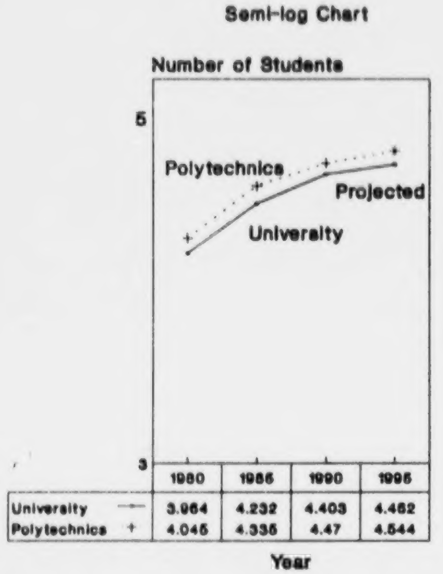
[62] Linda Low, Toh Mun Heng and Soon Teck Wong, *Economics of Education and Manpower Development: Issues and Policies in Singapore* (Singapore: McGraw-Hill Book Co., 1991), pp. 79-81.

Figure 2. Enrollment Growth in Tertiary Institutions



	1980	1985	1990	1995
University —•—	3.964	4.232	4.403	4.462
Polytechnics +	4.045	4.335	4.47	4.544

Source: Singapore: The Next Lap. Times Editions Ltd. 1991, and Author.

Admission Policy

Admission into the universities and polytechnics is merit-based. The central concern of Singapore's political leadership has been that *the importance of merit-based admission policy should not be compromised. If admission standards are lowered: (a) poor quality students would find it difficult to compete effectively during the university course with other better prepared students; (b) the resulting high drop-out rate would waste scarce resources; (c) lower quality students in general would adversely affect the learning of better students; (d) the graduate degree or diploma would be devalued; (e) poor quality graduates would not have the knowledge or skills to perform well and stay employable particularly in an increasingly technology-driven workplace; and (f) a pool of unemployed graduates would be created.*

Therefore, Singapore did not expand university and polytechnic places to cater for the primary purpose of satisfying private or social demands.[63] Only those who clearly had the potential to pass the course were admitted and pass standards were never lowered.[64] The system's central legitimacy was based on the principle that equal opportunities were open to all individuals regardless of background, who had the talents and motivation to succeed. In short, the system espoused the philosophy that an individual's success in gaining access to his/her advancement within the system is determined by his/her performance. In other words, in the trade-offs between greater equity and quality, Singapore's leadership chose quality.

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[63] Until 1991 ethnic Malays enjoyed full tuition subsidy. Since 1991, Malay students with a family income of S$2,000 and below get full tuition subsidy, while students with a family income between S$3,000 and S$4,000 per month get a 75 percent tuition subsidy. Any Malay student with a family income above S$4,000 has to pay full fees. However, they have to be admitted into the tertiary institutions on merit.

In order to maintain the quality of the degrees and diplomas awarded by the universities, standards of admission were set at a level comparable to that of the well-established British "red-brick" universities, such as Birmingham, Bristol and Manchester.[65] Due to stringent admissions standards and high-quality instruction, support services and facilities, attrition and drop-out rates were low. NUS for example, had a graduation rate of 95 percent, comparable to the British "red brick" universities.[66]

Admission is based on performance in the Singapore-Cambridge Ordinary ("0") and Advanced ("A") Level Examinations or their equivalent. At the "A" level, candidates wishing to enter the higher educational institutions must obtain at one and the same examination a minimum of two good passes in two relevant subjects plus a satisfactory grade in the General Paper. At the "O" level, candidates must obtain a pass in English (with at least a grade D7), and a second language (Mandarin, Malay or Tamil). Entry into the high-cost and intensively competitive faculties of Medicine, Dentistry and Law requires not only higher grades, but also additional aptitude, and communications and language skills.[67] The polytechnics, require candidates to "O" or "A" level in mathematics or science, before being admitted. The different levels of admission requirements by the two different tiers enable the universities to select the best from a crop of students entering the tertiary system.

This merit-based screening process for admission is purported to be an objective means of assessing ability. In this selection system, what a student has learned does not matter; how he has performed in a single examination matters. In other words, *Singapore has developed one of the most examination-driven competitive systems for rationing higher education opportunity.* The reliance on examination results has also encouraged students competing for admissions into the universities to rote learn details at the expense of intellectual creativity and the capacity for innovation. This has become an issue of growing concern to the Government, parliamentarians, employers and the public.

The two universities have a joint admissions office. Applicants seeking admission into the universities can list five choices in order of preference (from the list of programs offered by the two universities) for the courses into which they wish to be admitted.

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[64] Lee Kuan Yew, "Higher Education and Singapore's Future." (Address to the Political Association of the University of Singapore, December 23, 1977, Mimeo), p. 2.

[65] *The Straits Times*, March 7, 1988.

[66] *The Straits Times*, 5 July, 1988.

[67] Medical students have to undergo a Vocational Assessment Scheme as well as an interview, dental students are tested for manual dexterity, while Law students are interviewed to assess their competency in English.

In order for Singapore to have the right mix of high quality, talented graduate output in critical fields, the CPTE has "streamed" students into faculties and courses since 1979. This has resulted in many students not securing admission into the programs of their first choice. For example, a number of high achievers who have qualified for entry into a medical program and have indicated the program as their first choice have been channeled to do engineering or law.[68]

Through this policy of streaming, the CPTE ensures that the finest minds are not concentrated in one program and that critical fields like engineering and law have a fair share of the brightest students as well.[69] The administrative exclusion of highly-qualified students from the programs of their first choice, justified as a national need, has prevented them from realizing their primary aspirations. This has brought about considerable discontent among the student body and parents.

Unlike the past, additional pathways to university and polytechnic education are being provided to students. The Government has, since 1990, made the decision to allow students with "O" levels to go to university through either the traditional junior colleges or the polytechnics.[70] However, only the top 5 percent of polytechnic graduates are allowed to enroll for university programs. The high performers among these 5 percent can be considered for admission into the second year. In 1991, NTU and NUS admitted 382 and 20 polytechnic graduates respectively.[71] Similarly, from June 1991, vocational institute graduates (the future Technical Institute graduates) with a Certificate of Merit can proceed, if they so desire, to do full-time polytechnic programs.[72]

Because of Singapore's provision of high-quality primary/secondary education and its throughput, the pool of qualified applicants for recruitment into the tertiary institutions is steadily expanding. As the pool of qualified school leaving candidates increased, entry requirements and competition especially into the universities have become more intense. Table 8 indicates that between 1982 and 1987, NUS accepted only 50 percent of its applicants.

This situation is bound to continue until the institution of Singapore's proposed more open admission system comes into operation by the turn of the century. The Ministry of Education has forecast that, by that time, 60 percent of each age cohort will have tertiary education.[73]

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[68] Linda Low, et al., 1991, p. 111.

[69] Pang Eng Fong, *Education, Manpower and Development in Singapore*. (Singapore: Singapore University Press, 1982), p. 158.

[70] *The Sunday Times*, October 27, 1991.

[71] Ibid.

[72] Vocational and Industrial Training Board, 1991, p. 2.

[73] *The Sunday Times*, October 27, 1991.

Table 8. Applicants and Acceptance: National University of Singapore, 1982-87

Year	*Number of Applicants*	*Accepted*	*Percent Accepted*
1982	8,561	4,370	51.1
1983	8,977	5,364	59.8
1984	9,668	5,438	56.3
1985	11,535	5,422	47.0
1986	12,636	6,218	49.2
1987	12,982	6,530	50.3

Source: The Straits Times, February 23, 1988.

The Government feels that if high entry standards are not maintained, the degrees and diplomas awarded by the tertiary institutions will lose their market value. However, the criteria used for admission are examination-based. The probability of success in the examination may be closely correlated to the family background (income and socio-economic status), the variation in the quality of schools attended, and motivational factors. In other words, although all aspiring candidates compete on a level playing field, there appears to be an educational advantage of the rich over the poor, particularly for entry into medicine, engineering and law. In short, there is a possibility that there may be a strong plutocratic element beneath the meritocratic surface.

Closely tied to this policy of admission standards is the Government's view that university and other tertiary level enrollments should be strictly linked to development planning through the "manpower approach." To meet the country's current and anticipated manpower needs, student enrollments and course offerings in existing tertiary institutions were expanded and new institutions were established.

Singapore's policy-makers and planners contend that the base-level of throughput of relevant middle and high-level skilled manpower, which produces and enhances the technologically driven modern industrial society, had to grow and be continually upgraded if the Republic was to maintain its robust and competitive edge in the world market economy.

Apart from meeting the demand-driven manpower needs of Singapore, private and politically driven demands have also, to a lesser extent, contributed to the expansion of higher education. However, this has not been at the expense of the critical link between higher education and employment.

Private Demand

In the burgeoning middle-class and highly achievement-oriented society of Singapore, marketable higher education credentials are perceived as an important passport to a prestigious and stable career[74]—a good job and wages, social status, security and insurance for old age.[75]

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[74] Herant A. Katchadourian and John Boli, *Careerism and Intellectualism among College Students*, (San Francisco: Jossey-Bass Publishers, 1985).

This is supported by the high monthly mean wage of S$1,550 and S$1,769 that the university graduate can earn in the public and private sectors, respectively (Table 9), compared to a corresponding gross monthly mean average wage of between S$600 and S$700 for a non-graduate. It goes to show that a graduate has an initial starting wage of nearly three times that of a non-graduate or an income premium of 200 percent for a graduate over a non-graduate. In addition, the annual and lifetime earnings of graduates are generally higher than non-graduates.

The study on *Returns to Education Investment in Singapore* based on 1980 data shows that the private rates of return to graduates (unadjusted for ability) at 32.4 percent (pre-tax) and 29.5 percent (post-tax) is on the whole a very profitable investment on a tertiary education at 1980 rates of private cost and benefits.[76] A more recent study of highly educated workers, professional/technical and administrative/managerial groups indicates that these groups have benefited from an average increase in earnings of 7 percent per year over a 15-year period.[77]

Table 9. Gross Mean Monthly Wages of NUS/NTI Graduates

	Overall		*NUS*		*NTI*	
Sector	*1988*	*1989*	*1988*	*1989*	*1988*	*1989*
Government Departments	1,661	1,694	1,537	1,615	1,993	1,945
Statutory Boards	1,550	1,769	1,438	1,690	2,088	2,091
Private Organizations	1,449	1,550	1,398	1,484	1,524	1,648

Source: *The Straits Times*, November 10, 1990.

This is further reinforced by: (a) the occupational options open to a graduate, coupled with the many prestigious positions open only to graduates; (b) a near full employment for graduates; (c) a relatively small direct cost—until the late 1980s—to the student and parents, due to the heavy state subsidization of higher education; and (d) a major access to wealth and power. In other words, the boundary between graduates and non-graduates has become virtually sealed.

The possibility is very small that the income gap between graduates and non-graduates will narrow in the near future. In sum, there is a great differential between winners and losers. Winners please their parents, feel proud of themselves and enjoy high prestige and status in Singapore society. This has inevitably nourished the aspirations of students and parents towards higher education, resulting in rapidly increasing demand, particularly in the highly employable and lucrative fields of

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[75] Tony Tan Keng Yam, 1990, p. 47.

[76] Ng Siew Fong, 1987, p. 97.

[77] Judy Tan Choo Tee, "Singapore." In *Educational Unemployment in Asia*, ed. Hiromitsu Muta. (Tokyo: Asian Productivity Organization), p. 577.

accountancy, business management, engineering, information technology, computer science, medicine, and law.[78] This is helped by: (a) highly subsidized and high quality and democratized school system, and (b) a merit-driven, and until recently, a relatively cheap tertiary system.

Therefore, these factors served as a stimulus to a revolution of expectations and acted as an impetus for fierce competition to acquire a tertiary qualification. Very seldom was higher education sought purely for its intrinsic merit. This was supported by an employment system, particularly in the public sector, where high priority was placed on a person's academic achievement (grades) and perceived skills, rather than on an individual's overall ability.

Politically Driven Demand

The universal participation in high-quality primary education—even without compulsory education—and the expansion and upgrading of secondary education from the mid-1970s, increased the demand for tertiary education much faster than anticipated.[79] The upgraded secondary education system improved student performance at both the "O" and "A" levels Singapore-Cambridge Examinations. This was in spite of a rigid examination-driven streaming system, which controls the throughput of students from primary through secondary and Junior Colleges (Annex 7).

The Government has been and still is under increasing pressure from the Government Parliamentary Committee (GPC) on Education, members of parliament and educational pressure groups to review its highly rigid tertiary admissions policy and increase its intakes into the tertiary institutions. The Public Accounts Committee, the parliamentary overseer on the effective use of public funds, noted the high unmet demand for university places.[80] It is generally alleged that candidates rejected by the local universities, were getting places in other English speaking Commonwealth or American universities and are doing well.

In response to these pressures, the NUS and the Ministry of Education issued a joint statement emphasizing that all students with the requisite qualifications who are capable of passing its

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[78] Ng Siew Fong, 1987, p. 108, concludes that "Law, medicine, dentistry and commerce-related fields enjoy the highest private returns to higher education. Arts and social sciences yield the lowest private returns." In 1991, according to *The Straits Times*, October 16, 1992, the mean starting salary of graduates were as follows:

Law	.. S$1,883
Dentistry	.. S$1,950
Business Administration	.. S$1,498
Accountancy	.. S$1,498
Arts	.. S$1,434

[79] Singapore in the later part of the 1970s and the early 1980s undertook major educational reforms to upgrade the quality of school education to prevent wastage through drop-outs. The major thrust was the recognition that differences in student ability needed differentiated curricula initiatives that took cognition of the differences of ability among students. See *The Report of Ministry of the Education (1978)*, also known as the Goh Report.

[80] *The Straits Times*, February 20, 1987.

examinations will be admitted.[81] However, any change in policy to student intake can be implemented only if the additional student numbers are warranted by national manpower requirements and they do not jeopardize academic standards.[82] In other words, the aim has been to counter any mediocrity that may result through a supply-driven and a bloated higher education system.

Foreign Students

Despite the intense domestic pressure for university places by home students, Singapore currently provides between 15 to 17 percent of its university, and less than 10 percent of its polytechnic places to foreign students.

To gain admission into a tertiary institution, foreign students need higher academic scores than their Singapore counterparts. What's more, all foreign students: (a) must pay differential tuition fees; and (b) prior to entry into publicly-funded tertiary institutions must sign a bond to work in the Republic for a period of three years after graduation (as an obligation to the Singapore public for the high subsidy to their tertiary education). However, during the 1985-86 recession, foreign students who graduated from the local tertiary institutions and who could show evidence that they were unsuccessful in seeking employment in Singapore were released from their bond and were allowed to return to their home country.

The policy to have foreign students among Singapore's student population, according to the former Minister of Education, ensures that the tertiary institutions within the country do not degenerate into a parochial community.[83] The acceptance of foreign students at the expense of qualified Singaporean students has given rise to a certain amount of discontent among Singaporeans. However, the government's policy is that it is the price Singapore has to pay for diversity. A student body with a diverse cultural background and diverse points of view will contribute to a more dynamic intellectual environment and a richer undergraduate experience.

Furthermore, Singapore uses its high-quality, vocationally-oriented, and highly-subsidized higher education institutions as a vehicle to attract and use regional talents to support and enhance its skill needs. The admission of foreign students also enlarges the limited and continuously dwindling pool of indigenous talent, due to a declining school-going population since the mid-1970s. At the primary school level pupil enrollment has been declining rapidly, from 363,518 in 1970 to 257,932 in 1990, a decline of 29 percent in two decades (Table 4). In addition, the goal is to eventually assimilate foreign students into the Republic's permanent work force.

Finally, there are long-term intangible benefits, too, for Singapore. Foreign students who come predominantly from Malaysia and other neighboring countries are likely to be the future political and business leaders of their respective countries. Therefore, the personal contacts developed between foreign and local students may prove beneficial for the long-term development of Singapore.

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[81] *The Straits Times*, February 23, 1988.

[82] Ibid.

[83] Viswanathan Selvaratnam, "Student Mobility Within The Commonwealth: Growing Constraints, New Initiatives", *Research Working Paper 87.13*, Center for the Study of Higher Education, The University of Melbourne, 1987, p. 8.

Conclusion

In short, since 1960, the institutional landscape of Singapore's higher education has changed through an overall expansion and diversification of the tertiary education system. This change was underpinned by the needs of the restructured market-driven economy for skilled manpower and, to a lesser extent, by the increasing private demand for higher education.

The hegemony of the traditional elite mode of the university sector has been replaced by a well-structured, multi-functional and stratified labor market-driven tertiary system that meets the diverse needs of the economy. In the expansion of this structured and diversified system, the central goal has been to build up a pool of Singaporeans with the right knowledge and training for use, not as an end in itself.[84] *However, this goal was reinforced by an important principle, that technological and economic performance will depend both on an elite and on a broader base of educated and skilled workforce.*

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[84] *The Straits Times*, September 4, 1991.

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Overseas Education

Well-qualified young Singaporeans have been sponsored by the Government, statutory boards and the private sector for undergraduate and postgraduate programs relevant to national development in universities of the English-speaking countries. In many instances, their sponsorship was also through bilateral or multilateral agreements.

Since the mid-1960s the primary objectives of the Government in sponsoring the brightest students to an education at top overseas universities in the English-speaking world has been to: (a) expose them to the system, ideas, knowledge and culture of industrialized countries; (b) equip a core of graduates with informed and coherent thinking on issues of globalization of the economy and the increasingly international competitiveness facing the nation; and (c) train persons for the second echelon of political/administrative leadership positions. This policy was needed, in the view of the former Prime Minister, to compensate for the inability of the local university to produce persons with the flexibility of mind and attitude necessary to cope with new challenges and changes.[84] In short, meritocracy operates with the aim of getting the top brains to the top place,[85] which in the view of Singapore's leadership, will sharpen their competitive and productive edge.

Although the Singapore tertiary system covers a wide number of specializations, *the range was inadequate to produce all the different kinds of specialist graduates required for a rapidly modernizing society. Therefore, the government sends students overseas to be trained in these specializations, the rationale being that the demand for these particular branches of study was too limited for the program to be conducted locally in a cost-effective way.* In addition to the growing number of government-sponsored students for overseas study, there has been a substantial increase in the number of privately sponsored and self-financing students.

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[84] National University of Singapore Student's Union, "The Student Report on University Education in Singapore," *Singapore Undergrad*, Vol. 13, (1), 1980, p. 9.

[85] Roland Dore, *Diploma Disease*, (London: George Allen and Unwin Ltd, 1973), p. 50.

Sponsored Students

Government

The Public Service Commission (PSC) is the central agency for the planning and administration of undergraduate scholarships and bursaries offered by the Singapore Government and foreign governments and multilateral agencies. To seek out and attract the best persons to meet the manpower needs of the various public sector services, the PSC offers a wide range of very attractive scholarships, bursaries and awards for talented Singaporeans to pursue their undergraduate and postgraduate programs at overseas universities.

These very prestigious awards are grouped under two broad categories:[86]

Highly Competitive Awards. The President's Scholarships,[87] the Singapore Armed Forces (SAF), Singapore Police Force (SPF) and the Overseas Merit Scholarships.

Other PSC Awarded-Overseas Scholarships. These awards are designed "to suit a wide range of candidates with differing abilities."[88] However, the PSC emphasizes that securing any one of these awards is a first step towards a challenging and rewarding career in the civil service.[89]

There are no quotas for these awards and they are broadly categorized as "open" and "tied" awards. Recipients of "open" awards who have excelled in their undergraduate programs are appointed to the premier Singapore Administrative Service, if they have the aptitude for public administration work, or to the Professional Services relevant to the discipline they pursued. The "tied" awards are essentially to meet the specific manpower needs of services such as the Education and the Uniformed Services.

These awards are tenable at the most prestigious universities in the English speaking countries, mainly in the United Kingdom. In recent years, the overseas educational base has been broadened and a few scholarship holders have been sent to Japan, France and Germany (Annex 5 - Table E-1). To attract a few of the brightest students to take up humanities in Oxford and Cambridge, the PSC awards the PROMSHO (Pre-University cum Overseas Merit Scholarship for Humanities at Oxbridge) Scholarships. This scheme has now been extended to include the Ivy League Universities in the United States of America as well.

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[86] The total number of PSC awards to both local and overseas tertiary institutions in 1990/91 academic session was estimated to be 250.

[87] The President's Scholarships are the most prestigious and competitive of the scholarships. They are given annually to the most outstanding 'A' level students to undertake any program of study leading to a first degree either in an approved overseas institution of higher learning or in NUS/NTU.

[88] Public Service Commission *Scholarships Bursars Study Loans 1992*, (Singapore: Public Service Commission, 1991), p. 2.

[89] Ibid.

Other PSC awards for overseas study are to cater for the specialized needs of the various public services. The awards are based on the projected manpower requirements by the various services. The fields include, for example, Chinese Language and Literature, tenable in Taiwan, and Occupational Therapy, Forestry/Horticulture and Urban Planning, tenable in Australia and New Zealand.[90] Multilateral and bilateral schemes complement the well-organized and effective overseas education and training efforts of the Government.

The largest number of overseas awards go to those who choose a career in the education service, while the next largest number is awarded to candidates who opt for the uniformed services. The third largest number of awards are for paramedical programs—Nursing, Physiotherapy, Occupational Therapy and Speech Therapy.

The Government, through the PSC, offers a variety of attractive postgraduate awards to the best graduates of the NUS and NTU. All recipients of awards are required to sign a 3 to 8-year bond with the Government. However, for candidates who had received PSC undergraduate awards, the length of their bond is reduced to 3 years for the Master's and 5-years for the PhD programs.

Statutory Boards

Each of the statutory boards in Singapore operates an independent staff development program with an attractive overseas education and training component. These programs consist of long-term specialist academic training not available in Singapore and short-term professional training or up-dating courses.

Overseas education and training programs are undertaken to expose potential senior managers and other senior staff to alternative situations and institutions, as well as to enable them to develop overseas contacts for the benefit of Singapore's development effort. The National Computer Board's First Assistant General Manager points out:

> We need a pool of postgraduate staff because we need to concentrate on R&D. Information technology is an area that changes rapidly. No professional can remain static and be an effective professional. By training graduates, especially overseas, we're importing the latest technology back.[91]

Singapore's policy of training some of its brightest students overseas has paid high dividends. A majority of the foreign trained returnees, trained largely as technocrats in the top universities in the United States of America, Canada, the United Kingdom and Australia are put on a fast track for promotion. The high performers on this fast track now occupy the majority of the ministerial positions, as well as the key administrative positions in the ministries, the statutory boards and the uniformed services (armed forces and police). However, critics point out that the Government's policy to invest a disproportionate amount of its resources in a few highly talented students will further exacerbate the existing divisions in the society.[92]

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[90] Ibid; pp. 56-69.

[91] Diana Tan, "Aiming for a Higher Degree," *Mirror*, Vol. 24(3), February 1, 1988, p. 7.

Private Sector

Apart from the more important government and statutory board sponsored students, there have been expanding private sector sponsored scholarship programs for overseas studies. For example, Glaxo Singapore in 1989 introduced a ten-year S$50 million overseas scholarship scheme.[93] In addition, Singapore-based subsidiaries of British companies are sponsoring talented Singaporeans to undertake postgraduate studies in Britain under the Foreign and Commonwealth Office (Master's awards).[94] These awards are exclusively for course work Master's programs.

Self-Financing Students

Despite the huge expansion in student places in the existing and new higher education institutions; supply has not kept pace with the growing private demand for tertiary places.[95] The highly competitive selection policy and growing private demand has meant a widening, unmet demand, the extent of which has varied with different programs. More than half the eligible students who applied for places in the universities were not admitted, while the four polytechnics accepted 11,000 of the 16,000 applicants. They were rejected not due to a lack of ability but to the government's stringent policy to avoid an over production and mismatch of graduates.

Since there is no alternative for these students either through public or private provision, the gap between demand and supply at home has given rise to education overseas. Since 1981, their numbers have been growing (Table 10) and between 2,000 and 3,000 self-financing students seek overseas education every year. The 1990 census indicated that there were an estimated 15,300 students studying overseas and 75 percent of them were pursuing undergraduate degrees[96]. The total enrollment in the local public sector institutions is a little over 56,000. Singapore students are largely pursuing studies in the United States of America, the United Kingdom, Australia and Canada. Relatively smaller numbers are pursuing studies in Taiwan and Japan. The majority of the undergraduate students are in engineering, computer technology and business studies programs. Another group that sought a higher education overseas was polytechnic diploma-holders, who largely go to British universities as private students to upgrade their qualifications to degree level.

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[92] *The Straits Times*, February 8, 1992.

[93] British Council, *Higher Education Market Survey: Singapore*, 2nd ed. (London, 1989), p. 8.

[94] Ibid.

[95] One estimate points out that demand for places exceeds provision by at least 150% (see British Council, *Higher Education Market Survey: Singapore*, 1989, p. 1).

[96] *The Sunday Times*, June 28, 1992.

For the more affluent Singaporean, an overseas education in a prestigious university in an English-speaking country, is preferred for professional, social and economic reasons, and they have always made education overseas their first choice. Foreign educational qualifications in business administration, marketing and management seem to enjoy greater status and prospects of employability as well as higher wages (particularly with the multi-nationals) than local qualifications.

Table 10. Number of Singapore Students Enrolled in Higher Tertiary Institutions in the United States, the United Kingdom, Australia and Canada, 1981-90

Country	*1981*	*1983*	*1987*	*1990*
United States	1,840	4,500	4,870	4,460*
United Kingdom	1,447	776	1,782	2,220
Australia	771	638	895	1,921
Canada	961	1,111	1,101	1,572

* The figures are for the 1988-89 academic year.

Source: The 1981 and 1983 figures were published in a report by *The Straits Times*, January 7, 1985. The figures for 1987 and 1990 are from the United States Information Service, the British Council, the Australian Education Center and the Canadian High Commission.

Overseas education has been considered by some to be a potential loss to Singapore. The nation's highly talented students are siphoned off through the various coveted merit awards for an overseas education. This has deprived the local institutions and their student body of full interaction with some of their most capable students, thus diluting the intellectual quality of the local institutions and student body. The PSC has been asked, recently in Parliament, to send a greater proportion of its merit scholars to the local universities.[97]

Overseas study has also, through brain drain, hampered the expanding manpower needs in the critical areas of science and technology. Partly due to a lack of a liberal political environment, a number of Singapore students studying overseas have remained in their host country or have taken up jobs in third countries, after completing their studies. There is also evidence to suggest that Singaporeans who have returned after an overseas education are more likely to emigrate. The former Prime Minister, in a recent National Day address pointed out that in the 1980s, better educated Singaporeans from the top 25 percent emigrated to Australia, New Zealand, Canada and the United States.[98] Singapore, like Taiwan and Korea, has embarked upon an aggressive policy to reverse the trend of brain drain. Attempts are being made now to encourage Singapore's highly mobile and talented graduates abroad to return home, particularly from Australia, Canada and the United States of America where the recession has had an adverse effect on a number of Singapore graduates working in these countries.

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[97] *The Strait Times*, March 11, 1993

[98] Lee Kuan Yew, Prime Minister's eve of National Day speech, *Speeches*, Vol. 13(4), 1989, pp. 1-17.

5

Relevance and Quality

Structure and Content of Academic Programs

Undergraduate degree programs vary in length from three to five years, depending on the field of study. Architecture, medicine and dentistry take five years, while engineering and honors courses in arts, business administration, social sciences, sciences and pharmacy take four years. Most general degree programs are for three years. NUS has a direct three-year honors course for talented arts and social science students. The academic year at the NUS and NTU runs from July to March and is divided into two 16-week semesters separated by a four week break between the semesters. However, course offerings and requirements in NUS follow the British pattern of fixed course work and a final examination at the end of each year, rather than the American system of units and credits.

The tertiary institutions use English, the common working language of Singapore, as the medium of instruction because English is a universal language and is the dominant language in the areas of science, technology and commerce. In the words of the former Prime Minister:

> English has given us direct access to the knowledge and technology of the industrialized West. Without the continued use of English, Singapore would not have secured a new base for her economy, and brought up to date her role in the international and regional economy.[99]

The policy to learn and use English was considered to be a pragmatic way to master knowledge and, in particular, technology and thus enhance Singapore's competitive edge in the global market. However, the leadership constantly drums into its citizens that the use of English should not erode their deep-rooted links to their tradition and culture.

National University of Singapore

In addition to degree courses in the humanities, social sciences (including mass communications) and the sciences, NUS offers courses in the fields of medicine, law, dentistry, engineering, architecture, building sciences, accountancy and business administration. Although multi-faculty and multi-disciplinary in character, NUS, in response to Singapore's modernization and industrialization needs, gives priority to engineering, computer science, economics, business administration, medicine and law. The University, through its Department of Extramural Studies, also conducts short-courses, with the most popular being vocationally-oriented programs such as computer technology, management and accountancy.

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[99] Lee Kuan Yew, "Higher Education and Singapore's Future." (Address to members of the Political Association of the University of Singapore, December 23, 1977), p. 11.

Nanyang Technological University

The NTU offers degree courses in business, accountancy, applied science, computer technology and in various branches of engineering (civil and structural, electrical and electronics, and mechanical and production). The engineering courses are practice-oriented and relevant to the growing high-tech industries of the Republic. The business, accountancy and computer technology programs are designed for students intending to pursue a career in banking, finance, insurance, industrial corporations and the public sector and statutory boards.

In order to fulfill its practice-oriented degree program, the University requires its students to undergo a 10-week practical training program in-house and a 24-week internship with relevant business or industrial organizations. Its NIE, from 1991, will offer a four-year Bachelor of Arts degree with a Diploma in Education, a Bachelor of Science degree with a Diploma in Education and a degree of Bachelor of Arts/Science with a Diploma in Education (Physical Education).

Polytechnics

The polytechnics offer a wide range of vocational and practically-oriented, full-time and part-time diploma and advanced diploma courses in various fields of engineering, computer studies, mass communications and media, accountancy, business, legal and maritime studies, health sciences and biotechnology.

All full-time diploma students are attached for a period of eight weeks with industry. Since 1987, Ngee Ann Polytechnic has sent some of its students for industrial attachment in British, Japanese and Australian industrial plants.

The advanced diploma courses, including such fields as construction technology and power plant and food technology, come under the continuing education programs of the polytechnics. They are targeted to upgrade the knowledge and skills base of polytechnic graduates who have two years of relevant work experience.

In other words, the objective of the polytechnics is to keep in close partnership with industry. Through this close partnership with the industry, the polytechnics seek to provide the skilled technician and middle-level management and support staff that are in demand in the island's various economic sectors.[100] For example: (a) the Ngee Ann Polytechnic has established a Center for Quality to serve as a focal point for the collection and dissemination of state-of-the art ideas, information and materials to support the implementation of quality improvement programs[101]; (b) the Singapore Polytechnic's newly established CAD/CAM Center provides expertise in design and manufacturing for local industries[102]; and (c) the Temasek Polytechnic has a Technology Transfer Center to offer consultancy services to industry.

The four polytechnics have started regular lectures on general affairs to widen their students' interests and outlook. In order to enhance students' knowledge the polytechnics run workshops on topics such as quality assurance, value-added and zero defect in order to reinforce the message on performance.[103]

Other Centers of Public and Private Training

The third tier centers and institutes offer various certificates, diplomas and, in some instances, external degrees on a full-time and part-time basis. They provide quality-based programs tied to the professional and practical aspects of business and management. More importantly, they offer an expanding opportunity to adult students to upgrade and develop marketable skills in a rapidly changing technology and skill-based economy. However, these opportunities, as indicated earlier, are far from adequate.

The joint venture institutes established between the EDB, the Japanese, French and German governments and foreign firms are teaching factory training systems in which courses are aimed at producing industry-oriented technologists in real-life projects in various fields. The more common are computer-based information processing, control engineering, electronics, industrial automation and robotic application.

In short, *the central role of NUS, NTU, the polytechnics and other centers and institutes is to advance the scientific, technological and financial-cum-managerial capacity of Singapore's middle and high-level manpower*. The privately run financial-cum-management centers and institutes are, according to the Minister of Education,

> ... already a well established and growing private sector that offers such distance-learning and part-time programs in collaboration with reputable overseas universi-

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[100] Government of Singapore, 1991. p. 45.

[101] *The Sunday Times*, February 9, 1992.

[102] This new center, a collaborative effort between Singapore Polytechnic and Computervision Asia Pte. Ltd., a software manufacturer, will focus on the implementation of "concurrent engineering." Through this process various stages of an engineering process such as conceptual design, assembly layout, drafting and production engineering are carried out simultaneously. Concurrent engineering reduces development cycle time and improves product quality. The Straits Times, December 14, 1992.

[103] *The Straits Times*, October 21, 1992.

> ties... The Government should not duplicate what the private sector is doing well in this field.[104]

In other words, these are examples of a pioneering private provision of higher education through self-finance, zero subsidy and foreign collaboration.[105] The growing success of SIM demonstrates that as a private sector institute it is able to provide a quality and competitive product vis-a-vis the public universities, polytechnics and institutions. SIM's growing role has persuaded the Government to embark on a course of support to the private sector to offer additional tertiary level courses beyond its existing programs."[106]

Staff

To improve the quality of teaching, research and productivity, the tertiary institutions in Singapore hire talented staff and provide training to upgrade their skills and performance. The system, realizing that *inputs alone are not sufficient to improve quality and productivity, reinforces it with incentives, rewards and recognition as well as penalties.*

Staff-Student Ratio

The rapid expansion of the universities and the polytechnics has led to an unprecedented increase in academic staff. This expansion was further fueled by the strict adherence to the conventional labor intensive lecture-tutorial and laboratory-workshop mode. Singapore's constant desire for, and emphasis on high academic standards has driven the institutions to believe that quality can be achieved, not only from well-equipped teaching facilities and libraries, but also through a favorable staff-student ratio.[107]

Thus, the universities and polytechnics constantly upgrade undergraduate instruction and performance, through *small tutorial and laboratory-workshop groups*, supplemented by student written assignments, feedback and examinations. This requires the universities and polytechnics to make additional demands on staff time, delivery systems and administrative support.

To cope with this demand, the overall staff-student ratio norm is deliberately kept low (1:10), with a much lower ratio in medicine (1:6) and dentistry (1:4). Due to a shortage of staff, NTU in practice is operating with a higher staff-student ratio average (between 1:13.6 to 1:14.7).[108] The polytechnics maintain a staff-student ratio of 1:14.

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[104] *The Straits Times*, March 14, 1992.

[105] G. Shantakumar, "Student Loans for Higher Education in Singapore: Some observations," *Higher Education*, Vol. 23(4), June 1992, p. 407.

[106] *The Straits Times*, March 14, 1992.

[107] Henry M. Levin, "Raising Productivity in Higher Education," *Journal Of Higher Education*, Vol. 62(3), May/June 1991, p. 243.

There has been little compromise on these norms. Therefore, institutions have tried to keep the recruitment of their teaching staff in pace with the growth of their student numbers. Average teaching loads, between 9-10 hours a week in the university and 20 hours per week in the polytechnics (with an average of 5 student contact hours a week), is also used as an incentive to encourage staff to utilize their non-teaching work hours to do research and consultancy work. Polytechnic staff are not expected to do research. However, neither their teaching load nor their facilities readily support research.

Staff Recruitment

The Government's stated policy has been to develop a strong nucleus of local academics. A community of local staff would be "more reliable, having a commitment to the country that was complete and irrevocable."[109] However, this policy objective has not been implemented for three major reasons.

First, *the locally available pool of talent could not meet the demand for a wide range of academic staff specialization*. This shortage was further exacerbated by the deliberate policy of the government of channeling many of the best graduates into administrative and political leadership. In addition, the excellent career prospects and monetary incentives in the private sector attracted a lot of bright Singaporeans to take up undergraduate programs in accountancy, business management, law and medicine and to move into the financially more rewarding professions, rather than pursue the long grind of postgraduate studies for a less rewarding academic career.

Second, *to ensure that only staff with high professional and academic standards were engaged, international recruitment was necessary*. Otherwise, the leadership felt that the vitality of scholarship and quality will be threatened, particularly if recruitment was confined to a narrow pool of nationals. Therefore, Singapore's tertiary institutions complemented their local staff recruitment with a policy of robust international recruitment. Recruiting Units comprising senior academics and administrators regularly review the staffing situation. Overseas recruitment offices have been established in London and New York to help recruit expatriate, local and other ASEAN (Association of Southeast Asian Nations) country staff.

Third, *there exists a highly stringent tenure policy through which only 40 percent of the staff are tenured*. To be tenured, a local staff member, under the normal terms of service, has to fulfil two contracts of three years each, show teaching and research capabilities and publish, particularly in international journals.

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[108] Nanyang Technological Institute, *10th Annual Report 1990-91*, p. 7.

[109] National University of Singapore Student's Union, 1980, p. 9.

Higher education institutions periodically send recruiting teams of senior academics and administrators to Australia, Britain, Canada and the United States to interview potential candidates for staff appointments. In particular, Singapore's tertiary institutions took advantage of the loose international academic labor market of the late 1970s and 1980s to recruit high-quality expatriate staff on renewable three-year contracts to upgrade their faculty and start or expand undergraduate, postgraduate and research programs.

Academic salaries are high and fringe benefits apply (travel, settling-in-allowance, housing, gratuity, home leave, educational allowances, medical/dental and car loan). The national wage councils (salaries and bonuses) keep salary increases well above inflation levels. Staff members are allowed to undertake approved consultation/outside work of a specialized nature and retain fees of up to 60 percent of their annual gross salary in a calendar year. Medical and Dental faculty staff, with recognized higher professional or academic qualifications relevant to the discipline in which they are teaching, may opt to receive a monthly fixed allowance in lieu of consultation fees (Table 11).

Table 11. Monthly Fixed Allowance for Medical/Dental Teaching Staff

Staff	*Average Salary*	*Amount of Allowance*
Professors	10,660	2,750
Associate Professors	8,816	1,750
Senior Lecturers	6,635	1,250
Lecturer		
$3,850 and above	4,100	750
Below $3,850	-	500

Source: National University of Singapore, 1990.

Through this incentive package, Singapore's tertiary institutions are able to recruit high quality staff in an increasingly competitive international labor market. It is envisaged that the incentives would prevent a high turnover of good quality academic staff as well as attract new talent. This could help the institutions to achieve their objectives of becoming centers of excellence in teaching and research.

This has resulted in expatriates comprising between 16 and 20 percent of the universities' academic staff and between 8 and 12 percent of the polytechnics'. The majority of the expatriate staff are from the United States of America, the United Kingdom, Australia, Canada, New Zealand, Sri Lanka, India, Hong Kong and Taiwan.

Singapore's tertiary institutions expect expatriates to infuse new ideas and new areas of research and see this as healthy for academic development as well as for the quality of research and teaching. However, as a rule expatriates are not considered for tenured positions. Perhaps the contention of the authorities is that tenure might render the staff: (a) too self-satisfied; (b) reduce their efficiency; (c) not contribute to new ideas; and (d) increasingly grow ineffective. In addition, any higher education institution which has a proportion of tenured academic staff will experience a reduction in new staff hiring and cost increase or both.

In spite of the fact that expatriate staff receive good salaries and fringe benefits as incentives, the very lack of a personal career path and growth, which their short-term renewable contracts prescribe, makes them insecure and alienated. Thus by and large expatriate staff with little or *no opportunity for a career path and growth* are not integrated into the overall mission of Singapore's tertiary institutions. Therefore, they devote their time, at the expense of teaching, to their discipline oriented research in order to enhance their academic standing internationally and seek employment with tenure elsewhere. The universities, because of this policy, find it difficult to retain good expatriate staff.

Staff Development

Since 1969, the minimum academic qualification for staff in the non-professional disciplines is a Ph.D, the argument being that a Ph.D, representing three or more years of intensive course work and research, should be a requirement for appointment to any university whose pursuit is excellence.

For tenure and promotion within an academic department, academic qualifications, teaching ability and publications in professional journals of international and regional standing are major criteria. The penalty for poor performers—incompetent lecturers and ineffective researchers—who are local, is not to reward them with salary increments nor grant tenure. They are asked eventually to leave, while, in the case of unsatisfactory expatriate staff, their contracts are not renewed.

Every suitably qualified local staff member recruited at the senior tutor level is sent, under the staff training scheme, to an overseas university in the United States of America, the United Kingdom, Australia, Canada or New Zealand for Ph.D training. For example, at the end of the 1988/89 academic year, 114 staff members of NUS alone were pursuing postgraduate studies overseas. During the academic year 1989/90, NUS sent 29 staff members to top overseas universities for postgraduate studies, while 27 successfully completed their postgraduate programs and resumed their duties. In 1990, a total of 103 staff members were in overseas universities, pursuing postgraduate studies.[110] Overseas training is reinforced by a once in every five years sabbatical leave program of overseas study or research for tenured staff. Staff members are sent to conferences, seminars and workshops both overseas and locally in their areas of specialization. The basic aim is to enhance their skills and update their knowledge base.

Thus Singapore tertiary institutions are exporters of postgraduate students, even though the NUS and NTU have rapidly expanded their research and graduate study programs and are receivers of foreign postgraduate students. The rationale behind sending persons abroad for postgraduate study is fourfold: first, the right overseas training will expose the prospective staff member to a broader research field; second, it will provide an opportunity to interact with other researchers who are working in similar fields; third, the Singapore universities will build new academic links; and lastly, it will contribute towards high-quality teaching and research.

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[110] National University of Singapore, *Tenth Annual Report 1989-1990*, (Singapore, 1990), p. 21.

Nomenclature

The faculty nomenclature at both the NUS and NTU is a hybrid of the United States of America and British systems. The staff are ranked as follows: senior professors, professors, associate professors, senior lecturers, lecturers and senior tutors (formerly instructors).

With the adoption of this system of ranking from the late 1960s, a more flexible multi-chair composition of senior staff became possible within each of the teaching departments. This has to some extent helped to attract and retain talents, particularly within the high priority teaching and research departments.

The polytechnic staff are ranked as follows: principal lecturers, senior lecturers and lecturers. In addition, the universities have a Visiting Professor and Fellows Scheme, to attract and if possible, retain good teaching and research staff from overseas tertiary institutions.

Teaching and Learning

Undergraduate teaching is conducted through lectures, seminars and tutorials during the two semesters of the academic year and is given high priority. Lecture courses are designed to cover the ground prescribed in the particular course outline. Seminars and tutorials are held fortnightly to discuss in greater detail chosen topics within a course outline with a view to helping students prepare for the final examination. All students are expected to write a prescribed number of essays throughout the course of their studies.

The view is that the quality of student learning can be enhanced by raising the standard of academic staff teaching. Therefore, considerable emphasis is given to achieving excellence in teaching and learning. In order to achieve this, every effort is made by the institutions to stimulate the professional development of its academic staff. In the recruitment of academic staff, emphasis is not only given to all round high academic credentials and quality, but also to basic skills in teaching and pedagogy.

Since 1981, concerted efforts have been undertaken to improve teaching on a university-wide basis.[111] All newly-appointed teaching staff at NUS and NTU are inducted through a short Teaching Methodology program. In this short program, the emphasis is on learning and teaching styles, lecture and tutorial simulation methods, course evaluation and use of instructional media. Good teachers are given incentives through salary adjustments, promotion and tenure. This has been further enhanced through special awards for excellence in teaching at the Faculty or the University level. From July 1993, NTU plans to introduce a special training programs for new lecturers. These formalized, intensive and extended programs and incentives have been devised to make lecturers better teachers and tutors.[112]

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[111] Chen Ai Yen, "Trends and Issues in Improving University Teaching," *Higher Education Research and Development*, Vol. 7(1), 1988, p. 49.

In addition, more advanced seminars on teaching methodology are conducted by senior staff members and visitors to continuously upgrade and refine teaching skills. Teaching staff in the NUS have access to a useful *Handbook of Teaching*. NUS and NTU have a Center for Educational Technology and Center for Educational Development respectively, for improving teaching and learning. Their primary function is to provide consultancy and technical assistance to the teaching staff, in order to enhance the teaching and learning proficiency of the staff and students respectively.

There is considerable variation among the institutions in terms of the structure and organization of their teaching and learning activities. Increasing attention is being given to upgrading the quality of student skills in analytical and creative thinking, independent learning, human relations and team-work. Students are encouraged towards independent learning by supplementing their classroom learning with computer-based learning (CBL). Its aim is to improve self-driven and self-paced learning among students. It also enables the brighter students to explore and venture beyond what the curriculum requires of them.[113] The CBL and the provision of training to students in the use of the various academic databases and software packages is aimed at enhancing the learning productivity and knowledge base of the students.

Quality Control

The improvement of quality and standards is a central goal of all the higher education institutions and every effort is made to translate this into operational performance at the institutional level. For example, NUS has targeted to bring itself, by the year 2000, to the level of the best universities in the world, as well as to be acknowledged as the world leader in the areas of medical care and biotechnology, information technology application, artificial intelligence and expert systems, microelectronics and automation technology, construction technology, plant and animal tissue culture and biomedical engineering.[114] NUS and NTU professional degrees are recognized by various Australian, British and other industrialized countries' professional bodies. All NUS and NTU degrees are by and large recognized by most English-speaking universities for postgraduate studies.

In order for the institutions to achieve their objectives as international centers of excellence, the inputs provided in terms of students admitted and physical facilities are kept to a high quality. The policy not to admit any student who does not have above average 'O' and 'A' level results and a functional grasp of the language of instruction (English) has been a positive factor in enhancing quality.

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[112] *The Straits Times*, August 6, 1992.

[113] Lim Pin. "Maintaining Quality in Higher Education," Keynote Address at the *Eight International Meeting of University Administrators*, January 3-8, 1993, Singapore, p. 8.

[114] National University of Singapore, *A Decade of Achievement 1980-90*, (Singapore: NUS University Liaison Office, July, 1990), p. 2.

Students are required to pass the single terminal examinations at the end of each academic year. To qualify to sit for the end of the year examinations, a student has to attend lectures and tutorials in all course offerings as well as turn in essays that have been prescribed in each of the courses. A student is also required to complete his graduation within the maximum number of years allowed by the respective faculty regulations.

Yet, there are disadvantages in this system. *A single end of the year terminal examination as a system of assessment is far from sufficient to provide a good measurement of a student's grasp of the subject matter as well as his/her all-round ability. Since the examination grade is the sole determinant of a student's ability, students tend to regurgitate what they have learned by heart in the end of the year examinations*. The system also causes excessive stress and anxiety. There is no obvious reason why, with such a sophisticated system as Singapore has, that there should be any difficulty in implementing a well-structured continuous system of assessment for all its academic programs instead of the present method of recording and summarizing the performance in the end of the year examination by grade point average.

In order to maintain the quality and standards of their academic programs, both NUS and NTU have long implemented an external examiner system for each of their academic departments and programs. All external examiners are senior academics from overseas universities. The external examination serves as the single most useful mechanism to monitor academic standards and ascertain their comparability with other internationally established universities, evaluate strengths and weaknesses of course content and quality and comparability of grading in the examinations. However, with a growing and explicit diversity of course offerings within disciplines and departments, there are doubts that a single external examiner per department can cope with the task of evaluating the diverse areas of specialization within a subject area.[115]

An external peer review is used to evaluate senior staff for promotion. NUS and NTU Faculties and Schools have instituted a system of Advisory Committees made up of practitioners, industrialists and public-sector representatives from the respective fields to monitor and provide inputs to guide the curriculum structure and course content in order to make then relevant to the nation's economy. In other words, to create a program of delivery to match the needs of the client, rather than those of academics at the institution. Student (through structured questionnaires) and, in some instances, academic peer review feedback on staff teaching has been introduced in all tertiary institutions. The purpose is to provide an additional input for staff to improve teaching, course design and structure, and thus enhance the quality and relevance of course offerings. The polytechnics too have instituted structured quality assurance mechanisms, namely through course audit, review and monitoring.

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[115] Gareth Williams and Cari P. Loder, "The Importance of Quality and Quality Assurance," in *Quality Assurance and Accountability in Higher Education*, ed. Cari P.J. Loder. (London: Kogan Page, 1990), p. 8.

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Research and the University-Industry Nexus

Research

Research is seen as vital, not only for the reputation and legitimization of Singapore's universities, but also for maintaining internationally acceptable standards and assisting in economic development. The universities and their staff are expected to be actively involved in research. The polytechnics do not insist that their staff undertake research, but polytechnic staff are encouraged to undertake applied research and consultancy work.

Particularly in the universities, for staff tenure and promotion, overwhelming weight is given to high-quality applied research output and publication in international and regional professional journals rather than to creative teaching. Thus the universities have sanctified research as a measure of merit and the pressure to publish or perish is growing.

In addition, research is encouraged as an incentive to retain staff of high quality, particularly in the priority areas of management science, medicine, science and technology. Therefore, research facilities in the NUS and NTI grew in all faculties and schools, but, until the mid-1980s, they were fostered on an *ad hoc* and diffused basis.

In February 1986, in order to derive full economic and social benefits from technological innovations, *Singapore established a national science and technology research policy. This policy was to help the island city-state set priorities, determine its advantages, make choices among various fields and disciplines, and foster R&D links between university and polytechnics on the one hand and the public and private productive sectors on the other.*

The above overall research strategy was underpinned by the Economic Committee Report of 1986.[116] Multi-disciplinary research is encouraged into problems relevant to technological growth by pooling the available expertise and experience to bring about cross-fertilization of ideas. Whatever multi-disciplinary research is done within NUS or NTU has to be effective in dealing with practical problems in real-life and be in line with the country's development.

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[116] Report of The Economic Committee, *The Singapore Economy: New Directions*, (Singapore: Ministry of Trade and Industry, 1986).

Currently, just over 1 percent of the GNP is committed to R&D activities. This was a phenomenal leap from 0.3 percent in 1982 (Figure 3). *As potential areas of research are growing exponentially, Singapore's policy was to set realistic goals. Therefore, the strategy was to prioritize its research choices. Since Singapore does not have a research tradition nor an advantage in fundamental research, it judiciously pursues an R&D policy which concentrates on incremental technology that is beneficial to Singapore's long-term economic strategy.* Under this strategy, the research capabilities of NUS and NTU have been appreciably strengthened in order to help them embark upon a coherent and long-term postgraduate education and research program. This development aims to serve national needs through cooperation with business and industry.

To support research and enhance its quality and productivity, NUS has a large central library and five specialized libraries with a collection of over 1.6 million books and bound journals, including some research collections. In addition, the library has a current periodical subscription of about 13,000. To keep up with the vastly expanded demand for material and information, the library has a computerized information access and transfer system. The NUS student-book ratio was about 1:800. The NTU, in spite of being a relatively new institution, holds a rapidly growing collection of over 400,000 volumes, with the bulk of the holdings in engineering, business studies and accounting. Both institutional libraries are fully computerized, and have access through a library On-Line Information Search Service which is linked to DIALOG, a very large and comprehensive information retrieval system based in California and linked to 320 databases containing more than 175 million records in science, engineering, technology, computers, chemistry, education, business, finance, economics, current events, etc. They also are members of SILAS (Singapore Integrated Library Automated Service), through which users can share resources among the network's 34 participating libraries. In addition, since 1987, NUS and NTU have had a satellite link to BITNET which enables staff to communicate with their professional counterparts in over 400 universities in the United States of America, Canada and Japan. All this is to provide up-to-date information quickly and easily to researchers in any subject area as well as to create an Information Technology Culture[117] under its comprehensive National Information Technology Plan (NITP) issued in 1986.

In line with the policy of establishing centers of excellence in research, NUS has set up two types of facilities:

(a) the specialty research institutes; and

(b) faculty based research centers.[118]

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[117] Rajendra S. Sisodia, "Singapore Invest in the Nation-Corporation," *Harvard Business Review*, (May-June), 1992, p. 40.

[118] National University of Singapore, *General Information*, (Singapore, 1992), pp. 16-17.

The specialty research institutes are:

1. Institute of Molecular and Cell Biology (IMCB)—plays the key role in strengthening the infrastructure for basic biomedical and biotechnological research in Singapore.

2. Institute of System Science (ISS)—the mission of the institute is to deliver new ideas and products relating to Information Technology through research, development and education in strategic partnership with external organizations.

3. Institute of Micro Electronics (IME)—provides a national focus for R&D in the area of micro electronics.

4. National University Medical Institute (NUMI)—when fully operational in 1995-96 will spearhead and co-ordinate the medical research activities and projects of the diverse medical departments.[119]

The faculty based research centers are:

1. Center for Advanced Studies in the Faculty of Arts and Social Science—promotes research, conferences and publications with a multi-disciplinary emphasis.

2. Surface Science Center and the Image and Signal Processing Center under the Faculty of Science—these Centers conduct multi-disciplinary research.

3. Center for Business Research and Development and the Center for Management in the Faculty of Business Administration of Technology—these Centers spearhead collaboration with professional and entrepreneurial partners in industry.

4. Center for Building Performance and Construction and Center for Real Estate Studies in the Faculty of Architecture and Building (to enable staff to do research and consultative work for government organizations and companies in the private sectors).

5. Center for Optoelectronics, Center for Integrated Circuit Failure Analysis and Reliability and Magnetic Technology Center in the Faculty of Engineering—these research Centers are in line with the university's policy of establishing R&D centers of excellence to support private sector companies. In addition, the Faculty of Engineering has a Bioprocessing Technology Unit to facilitate R&D and manpower training in bioprocessing.

6. Center for Research in Human Socomotion, Preosthetic Research Center and Center for Assisted Reproduction Techniques have been established in the Faculty of

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[119] Ibid.

> Medicine. In addition, the faculty has five WHO collaboration Centers for Enteroviruses, Immunology, Material and Child Health Information and Histological Classification of Upper Respiratory Tract Tumors.[120]

NTU has also embarked upon an active and innovative research program in its various Schools and Research Centers or Institutes. The aim is to take a lead in research areas relevant to industry and business, and at the same time to nurture and cultivate a research culture and an environment for the promotion of scholarship and creativity.[121] Within a short span of time, the University has established eight research-cum-consultancy oriented centers. They are:

1. Entrepreneurship Development Center (ENDEC).
2. Grumman International/Nanyang Technological University Institute of Computer Integrated Manufacturing (GINTIC) Institute of Computer Integrated Manufacturing (CIM).
3. Institute of Manufacturing Technology (IMT).
4. Microelectronics Center.
5. Center for Advanced Construction Study.
6. Center for Transportation Studies.
7. Computer Graphics Center.
8. Innovation Center.
9. Center for Applied Research in Education.

Both NUS and NTU have fostered links with top-ranking overseas research universities in the United Kingdom, Europe and the United States of America. For example, NTU has forged a research link with the Sloan School of Management of Massachusetts Institute of Technology (MIT) on global and regional issues and a five year collaborative engineering joint-research program with the University of Cambridge.[122]

Postgraduate Studies

Local postgraduate study, like research, was not an area of concentration up to the early 1980s. In spite of this, postgraduate studies developed in business administration, the arts and social sciences, law, science, medicine, building and estate management and education. NUS established Postgraduate Schools in Management, Dentistry, Engineering and Medicine and a Center for Advanced Studies in the Faculty of Arts and Social-Science, and a Chinese Language and Research Center.

Apart from reiterating the requirement of a better educated and trained workforce, the Economic Committee Report of 1986 emphasized Singapore's need to accelerate post-graduate education through the expansion of Master's and Ph.D programs. The Committee stated:

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[120] Ibid.

[121] Nanyang Technological University, *Research in NTU*, (1991), p. 2.

[122] *The Straits Times*, July 10, 1992.

> In the last five years, our universities concentrated on expanding and improving undergraduate education. While consolidating the considerable success achieved, we should now extend our focus to postgraduate education. A sizable postgraduate student population will foster a more stimulating environment in our universities.[123]

The Committee went on to add:

> As more of our companies engage in R&D, there will be greater demand for more qualified research scientists and engineers.[124]

From 1986, in line with the Economic Committee Report, NUS has pursued an aggressive policy in its postgraduate training to enhance its programs through maximizing the use of its available resources.

In 1990, NUS had more than 1,660 postgraduate students (Table 12) compared to 332 in 1980. In addition, since 1983, the School of Management at NUS and the Business School at Stanford University have jointly organized an annual Stanford-NUS Executive Program. The MBA has become the most keenly sought after postgraduate program in Singapore. The combined full-time and part-time MBA enrollment in NUS, NTU and SIM was estimated to be more than 1,200 students. In addition, close to 20 foreign universities are offering the MBA through distance-learning.[125]

Of the 1,660 postgraduate students in NUS, 213 (13 percent) were registered for doctoral degrees, 1,303 (78 percent) for Master's degrees and 144 (9 percent) for diplomas. Of this total, 645 were pursuing their studies by research and the rest by course work. Research Scholarships were awarded to 201 full-time students.[126]

NTU offers postgraduate programs leading to the award of Master's degrees through research (Accountancy, Arts, Science, Applied Science, Business, and Engineering) and through course work and dissertation (Business Administration, Education, Airport Engineering, Communication and Computer Networking, Computer Integrated Manufacturing and International Construction Management), Doctor of Philosophy (research only) and postgraduate diplomas (course work and dissertation).[127] There were in 1991, 87 students working for the Master's degree by research and 19 students working for the Ph.D degree.[128] NTU plans to expand its postgraduate training and research through an increase in student enrollment to 1,000 by 1995.

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[123] Ibid., p.116.

[124] Ibid., p. 129.

[125] *The Sunday Times*, October 20, 1991.

[126] National University of Singapore, *Report on Postgraduate Studies for the Academic Year 1989-1990*, p. 1.

[127] Nanyang Technological University, *Prospectus for Postgraduate Degree Programs*, (October, 1991), p. 1.

[128] Nanyang Technological University, *Research in NTU*, (1991), p. 3.

Table 12. Postgraduate Student Enrollment by Discipline in NUS, July 1990

Faculty/Institution	*Total Enrolment*
Architecture & Building	120
Arts & Social Science	95
Business Administration	431
Dentistry[a]	1
Engineering	460
Law	36
Medicine[b]	100
Science	319
Institute of Molecular & Cell Biology	41
Regional Language Center (Applied Linguistics)	7
Institute of Education	77
Institute of Systems Science	73
TOTAL	1,660

[a] Including School of Postgraduate Dental Studies
[b] Including School of Postgraduate Medical Studies

Source: NUS Annual Report 1990/91

In both NUS and NTU, postgraduate education emphasizing engineering, information technology and business administration are targeted towards

> ... improving the technological proficiency of the industries, improving management skills and business efficiency, and supporting high technology and research and development (R&D) activities.[129]

In order to stimulate intellectual vitality within the academic departments, attractive postgraduate and research scholarships and fellowships are offered by the universities through international competition. The intention is to attract the best talents, irrespective of nationality. A few companies have also provided scholarships for postgraduate studies.

The research scholarship, tenable up to three years, carries a monthly stipend ranging from S$1,400 to S$1,800 and is pegged to the starting salary of a university graduate in Singapore. The research scholarships are renewed for the following year only if the student's academic performance is satisfactory. In addition, two prestigious programs, the Lee Kuan Yew Post-Doctoral Fellowship and the Lee Kuan Yew Distinguished Visitor Program, have been instituted. The first is to attract young and promising scholars worldwide to undertake research in science, technology and business; the second is to invite distinguished scholars. Both of these programs are tenable either at NUS or NTU.

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[129] Ibid., p. 116.

University-Industry Link

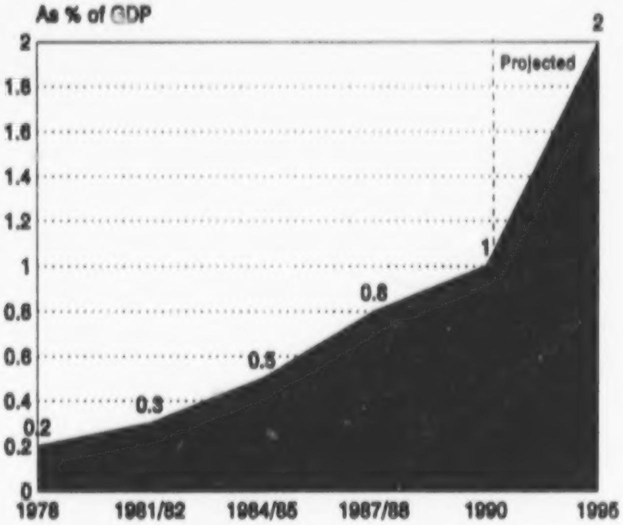
Informal links between individuals in NUS, NTU and the polytechnics and industry on specific projects have existed for a long time. In 1978 the government introduced generous incentives through tax rebates, a Research and Development Assistance Scheme (RDAS) and Product Development Assistance Scheme (PDAS) to facilitate co-operation between industry and the university. This has been further beefed-up through Singapore's *National Technology Plan 1991*.[130] The plan to accelerate R&D activity lays down important and crucial targets to be achieved by 1995. It is envisaged that by 1995 (Figure 3):

a. the total national expenditure on R&D will reach 2 percent of GDP;

b. the private sector will account for a minimum of 50 percent of this total; and

c. the ratio of the number of scientists and engineers engaged in R&D activities will be 40 per 10,000 labor force.[131]

Figure 3. Singapore's R&D Expenditure



Source: National Science and Technology Board, 1991, p. 8.

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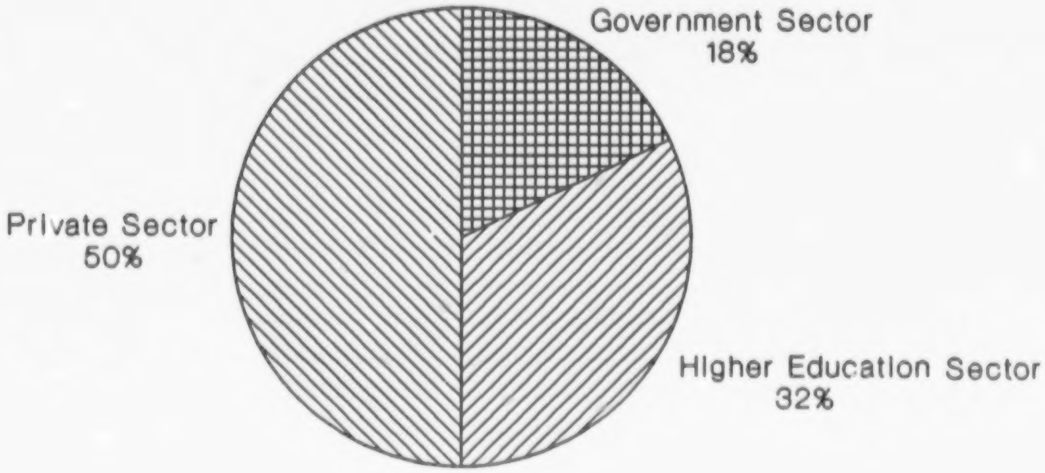
[130] National Science and Technology Board, *Science and Technology: Window of Opportunities (National Technology Plan 1991)*, Singapore, 1991, pp. ii-iii.

[131] Ibid.

A large number of the university staff are engaged in consultancy work with the public and private sectors. After 1985, with the initiation of the Technology Associate Scheme, industry participation in university research was encouraged, and this has grown. This has accelerated university-industry collaboration of R&D. Additional, effective and appropriate fiscal incentives have been put in place since 1991, to further encourage R&D by larger local companies and the MNCs.[132] The private sector has increased its share of R&D expenditure since the mid-1980s. It now accounts for 59 percent of the R&D expenditure in Singapore (Figures 4 and 5).[133] This has helped the higher education sector to reduce its commitment to R&D from 32 percent to 19 percent (Figures 4 and 5).

Figure 4. R&D Expenditure Share by Private and Public Sectors, 1984-85



Source: National Science and Technology Board, 1991, p. 9.

Since 1986, a 115 hectare Science Park located next to NUS has been developed into a center of industrial R&D and high technology. In January 1991, in order to play a more productive coordinating and facilitating role in promoting R&D, the Government upgraded the Singapore Science Council, which also oversees the Science Park, into a National Science and Technology Board (NSTB) under the Ministry of Trade and Industry with a specific mission to develop Singapore into a Center for excellence in selected fields of science and technology so as to enhance the national competitiveness of Singapore in the industrial and service sectors.[134] The eventual aim is to develop NSTB into a "one-stop technology Center" covering the entire cycle of R&D and focus its goal to promote industry-driven R&D. The Park's proximity to NUS and NTU has fostered close academic staff interaction and pooling of talent between industrial researchers and the universities to undertake joint consultancy and R&D projects.[135] The objective is to create a technopolis with an attractive environment to attract and retain scientific talent. It is hoped that the technology corridor, between the area that runs from the Science Park through the NUS in Kent Ridge and NTU in Jurong will turn into a technopolis. This area has a concentration of tertiary and research institutions, high-tech business activities, housing, social and recreational amenities, and good communications access to other parts of the island Republic.

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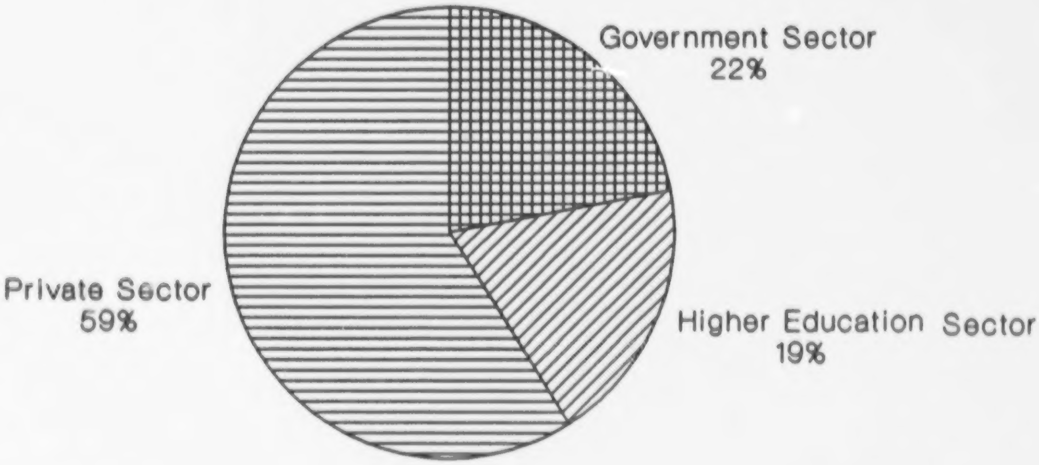
[132] Ibid., p. 55.

[133] National Science and Technology Board (NSTB), "Singapore: Technology for Economic Growth," *Scientific American*, Special Advertising Section, January 1992, p. 5-6.

Figure 5. R&D Expenditure Share by Private and Public Sectors, 1990



Source: National Science and Technology Board, 1991, p. 9.

To provide consultancy services, NUS has an Applied Research Corporation. Members who do consultancy work of a specialized nature can retain staff fees of up to a limit of 60 percent of their annual gross salary in a calendar year. NUS has since 1992 set up Industry and Technology Relations Office (INTRO) to enhance cooperation in R&D between NUS and industry.[136]

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[134] Ibid.

[135] International Development Research Center, *University—Production Sector Linkages*, (IDRC-MR2800, May, 1991), p. 79.

[136] *The Straits Times*, September 19, 1992.

The NTU has established an Industrial Liaison Unit to support the interfacing between the University and the industries in the areas of professional training, career opportunities and technical consultancies. To provide consultation and in-house scope for research and development for industries, NTU has developed an on-campus mini-science park called the Innovation Center. The primary aim of this Center is to act as a "catalyst through which new ideas for the industrial sector can be brought to commercial fruition by cooperative research and development with the University."[137] A number of local and MNCs based in Singapore with ideas of commercial potential have located their R&D activities within this Center and work collaboratively with NTU staff and students at the Center.

The EDB and NSTB jointly administer the incentives to encourage the link between the university and industry. The Government has also attracted large computer companies like Hewlett-Packard (HP), International Computer Limited (ICL), International Business Machines Corporation (IBM) and Nippon Electric Company (NEC) to provide computers and assist in training in the tertiary institutions of Singapore. This collaboration was aimed at helping applied research grow as well as to achieve a more direct and rapid application of research results to commercial utilization.

R&D activities are expected to be both practical and applied. This has been enforced with the introduction of legal protection of intellectual property which patents and protects R&D inventions. This valuable information in turn is disseminated for application in the nation's economic growth.

Staff-Government Link

Since the 1960s, the local academic staff have been increasingly involved in various national and community activities. A number of academic staff both of NUS and NTU are members of parliament. Some of them are on secondment to serve either as Ministers or Ministers of State, Ambassadors, representatives at the United Nations or in various other capacities, all of which are in the national interest. Staff are also called upon to serve in various government and statutory bodies as well as in key government economic and welfare committees. In addition, a number of staff members have been appointed or elected to serve in various national and professional bodies.

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[137] Nanyang Technological University, *Innovation Center: Transforming Innovative Ideas into Commercial Reality*, (Singapore, n.d.).

7

Government-Institution Relations

Governance and Management

Universities

Since the tertiary institutions in Singapore are state financed, the Government maintains a considerable voice in their management; they come directly under the purview of the Ministry of Education, and the polytechnics in particular, come under the Minister-in-charge of polytechnics. A University Grants Commission has been established to act as a buffer organization between the Government and the universities. However, this is still in an incipient stage.

The Governance and management of NUS and NTU are defined by the respective *National University (Singapore) Act* and *Nanyang Technological University Act*. According to these Acts, the universities are governed and managed by the Council, the NUS Senate or the NTU Academic Board, the Central Administration, the NUS Faculties or NTU Schools, the various Departments and the specialized Institutes and Centers. The head of state is ex-officio Chancellor of the two Universities. The Chancellor appoints the Council members and the NUS Vice-Chancellor or NTU President on the recommendation of the Minister of Education. Deans, Heads of Departments and Directors of Institutes and Centers are appointed by the Vice-Chancellor.

The Council acts as the governing body and oversees the financial and administrative policy. The Council of NUS, comprising 17 members has representatives from the University including the Vice-Chancellor, the Government and the private sector. The Council of NTU is made up of 15 members, representing the government and the private sector and includes the Vice-Chancellor of NUS. In the current Councils of both universities, the members include the President of NTU, the Permanent Secretary of the Ministry of Education and a Member of Parliament.

The Senate (NUS) and Academic Board (NTU) are the academic authorities of the respective universities and comprise all the Deans of Faculties and Schools (NTU), Heads of Departments, Directors of Institutes and the Chief Librarian. The Vice-Chancellor (NUS)/the President (NTU) are the Chair of the respective Senate/Academic Board, while the Registrars are the Secretaries. Both the

Council and Senate/Academic Board have their respective standing committees to carry out the various functions of the universities.

As the Government currently provides near to 75 percent of the funding, the broad policy guidelines are those acceptable to the Government, in which the CPTE plays an important role. Within these policy guidelines, the universities enjoy a considerable amount of internal freedom to:

(a) Select and admit their student body.

(b) Design their course content and delivery.

(c) Prescribe their examination policy.

(d) Carry out their staff appointments and promotions.

(e) Administer their financial management.

However, in their student intake and course offerings the universities have to follow the broad guidelines prescribed by the CPTE.

In keeping with British tradition, the Chancellor officiates at the various functions of the two universities. There are three Pro-Chancellors for NUS and one for NTU to assist the Chancellor in his various official functions. The Vice-Chancellor (NUS) and President (NTU) are the chief academic and executive officers of the respective University's central administrations. They are supported by a Deputy Vice-Chancellor (NUS) or Vice-President (NTU), a Registrar for administration, a Bursar for finance and a Chief Librarian.

In addition, NUS has a Personnel Department, Alumni Affairs Office, University Liaison office, Student Liaison Office and Estate Office, each headed by a Director. The NTU President and Vice-President are assisted by a Registrar, a Bursar, a Chief Librarian and Directors of Personnel and Student Affairs. The NIE has a Director who reports to the President of the NTU.

Polytechnics

The polytechnics are governed by a Board of Governors or Council appointed by the Minister-in-charge in accordance with the relevant statutes of the Polytechnic Act. The Board of Governors or Council members of each polytechnic consist of prominent persons from business and industry, employers, trade unions, the army and the Government and includes the Principal, the chief academic and executive officer, of the polytechnic. The polytechnics are assisted by one or more deputies, heads of departments or schools and administrators in the areas of finance, human resources, student affairs, academic and corporate affairs, estates and property, library and computer services.

Management Orientation

The tertiary institutions are management oriented. Therefore, emphasis is given to the enhancement of management and work performance skills of the administrative and support staff, respectively. In addition, there is considerable emphasis on the infrastructure of management and computer and information technology.

All vital information relating to students, staff, finance, etc., is computerized. The statistical data collected on students, staff and finance are analyzed and incorporated into the relevant annual reports. Both the technology and the data are constantly up-dated. In addition, support staff skills are continuously upgraded to increase productivity, and team work is used to achieve greater efficiency and cost-effectiveness.

Autonomy

Before 1959, the colonial government determined the structure, institutional arrangement, medium of instruction and student composition of the tertiary institutions in Singapore (including Malaya till 1957). In post-colonial Singapore, it was the Government of the People's Action Party (PAP) that molded the institutional fabric of the higher education system. At every stage of the country's political and economic development, *the Government, through its constant interventionist policy, has directed the higher education institutions to respond to and adapt to the major societal changes and needs.*

State control over the first tier institutions, the University of Singapore and the Nanyang University, has evolved over a period of time, through a series of confrontations between the Government and the Universities. Since the second tier institutions were subject to close administrative and financial control under the purview of the Ministry of Education, Government directives were easily implemented without any overt dissent and tensions.

The University of Singapore, up to the mid-1960s, though fully state-supported, enjoyed a considerable amount of autonomy.[138] The university's overall administrative policy was free from direct political interference as long as the university kept to its broad objective of meeting the higher-level manpower needs of the country within the resources available to it. Academic staff enjoyed considerable freedom to pursue individual teaching and research in accordance with their own discipline and professional judgement. However, this freedom was eventually eroded through a series of confrontations between the University and the Government. Three major catalysts contributed to this erosion of university autonomy. With the occurrence of each one of these incidents, state control has been enhanced over the university system.

The first of these incidents, was the "Enright affair." In November 1960, Professor D.J. Enright, an expatriate Professor of English, gave his inaugural lecture on "Robert Graves and the Decline of Modernism." In his lecture, Enright made some critical comments on the PAP Government's attempt to clean up Singapore society of "yellow" culture and, in its place, to prescribe what was viewed as a broadly acceptable culture. The Government immediately reacted by accusing Professor Enright of meddling in the country's internal affairs and gave him a stern warning that a repeat or similar act on his part would lead to the cancellation of his professional visit pass. The Academic Staff Association and the student body criticized the Government's action as an attempt to curtail the University's autonomy.

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[138] See Roland Puccetti, Authoritarian Government and Academic Subservience: The University of Singapore. *Minerva*. Vol.x(2) April 1972. pp. 223-41.

This incident was followed by a significant remark by the former Prime Minister:

> How are we to know where the bounds of academic freedom end and the boundaries of political issues begin? .... If you are an authority on Greek literature but a non-citizen then you would be wise to leave the question of whether or not Malay should be the only language to those who are citizens ... the best thing is to stick to your subject ...[139]

The second, and the most eventful of the three incidents, centered around the introduction of the Suitability Certificate in mid-1964. A year before its introduction, the Government requested the Vice-Chancellor to remove from the list of candidates admitted for the next academic session those students the Government suspected of being subversive. The Government's intention was to prevent the enrollment by the University of any highly politicized left-wing students, especially the Chinese middle school students, and thus keep the campus free of potential disruptive elements. The Vice-Chancellor, in refusing to accede to this request, categorically stated that this was political interference and thus an infringement on university autonomy. The Vice-Chancellor pointed out that university tradition favored admissions on merit and not on the basis of a candidate's political beliefs, gender, race, etc. This impasse was resolved in favor of the Government, when the Government threatened to discontinue financial support to the University. The Vice-Chancellor was forced to resign and a new Vice-Chancellor took over who was a long-standing member of the academic staff but was apolitical. The Suitability Certificate was introduced through an amendment to the Internal Security Act in 1964.[140]

The third incident occurred in 1966. Four final-year of Faculty Law undergraduates, all Malaysians, were deported and another 67 Malaysian students from Nanyang University were expelled by the Government for what the Government regarded as meddling in the internal affairs of the country. Since the four law students had not violated any university regulation and had not been expelled from the university, the Dean of the Law Faculty proposed to the University Senate that the students be allowed to sit their final examinations in absentia across the causeway in Peninsular Malaysia. The Senate refused on the grounds that the government might withhold the University's financial allocation if the Senate did allow this—a decision that showed how corrosive of university autonomy the power of the purse string could be.

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[139] Quoted in S. Gopinathan, "University Education in Singapore: The Making of National University," in *From Dependence to Autonomy: The Development of Asian Universities*, eds. Philip G. Altbach and Viswanathan Selvaratnam, (London: Kluwer Academic Publishers, 1989), p. 214.

[140] The Suitability Certificate was withdrawn in 1979 when the Government was assured that the number of secondary school and tertiary students actively involved in communist backed subversion had dwindled to insignificance.

With the sudden death of the Vice-Chancellor in late 1967, the Government appointed in April 1968 the Deputy Prime Minister as Vice-Chancellor; he was a former Reader in Physiology in the University of Malaya, then in Singapore (Appenix 1) and a founding member of the PAP. He was released from his duties as Deputy Prime Minister but concurrently served as the Minister of Science and Technology and the Chairman of the Board of Governors of the Singapore Polytechnic. In addition, appointments of PAP representative were made as members to the University Council and Senate as well as to important administrative positions within the University's Faculties and Departments. The polytechnic too had PAP representatives in its Council and various committees.

This gave the PAP government a means of direct control and influence over the day-to-day administration of the only university and the Singapore polytechnic. In return, these two institutions had a direct link to the PAP and Cabinet. The Vice-Chancellor, it was noted, "... exercised from the beginning his right as chairman ex-officio of the Senate and of virtually every committee, to control the university down to the smallest detail."[141] This was also the case with the polytechnics. His successor was the ex-Permanent Secretary of the Ministry of Education, and in 1980, the then Senior Minister of State for Education and later Minister of Education was appointed the Vice-Chancellor. Currently the Vice-Chancellors of both universities are academics. The heads of the polytechnics too are professional appointments.

Student political activities were curbed through legislation. To prevent any effective student alliance with outside organizations, particularly with workers, the Government passed the University of Singapore (Amendment) Bill in 1975. Through this bill the University of Singapore Students' Union (USSU) was reconstituted. Henseforth, USSU was brought directly under the control of the Minister of Education and the University Council.[142] With the introduction of the Bill in 1975, the student body's activities and finances were brought under the close purview of the University administration.

While the relationship between the PAP, the Government and the tertiary institutions has become blurred because of the extent of direct Government involvement in the affairs of the institutions, it is fair to say that the tertiary institutions in Singapore are state controlled, supervised and managed. Since the Vice-Chancellor and President of the NUS and NTU are appointed by the Government, they are more accountable to the Government than to the Councils and communities of the universities.

Given the fact that Singapore's survival rested upon the development of its human resource potential to its maximum capacity, the Government may have taken the view that decisions of Deans, Heads of Departments, etc., are not always the best decisions for rapid economic growth, and that higher education is too critical an issue to be left entirely in the hands of academics, who are too entrenched in their specialized disciplines and in the traditional notion of academic freedom and academic decision-making to respond promptly to the rapidly changing needs of Singapore society. A recent USA study points out that "Left alone totally to its own, the university will evolve towards self-interest rather than public interest."[143] In sum, the Government contention was that the academics lacked the aspiration and commitment to tackle the national agenda of the day. Therefore, from the Government's perspective there was a need for a central leverage to vitalize the pivotal role of universities in national development priorities.

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[141] Roland Puccetti, 1972, p. 231.

[142] Garry Rodan, 1991. p. 116

In short, Government saw the need for a nationally managed tertiary system under direct political supervision, governed by managerial rather than collegial or academic principles. Within this system "University administration is carried out by the administrators, leaving teaching and research for academics and learning for the students."[144] Therefore, the majority of the academics feel that they have very little share in decision-making and hardly any influence in academic policy. The bureaucratic practice has undoubtedly caused some resentment among staff members. Many decisions that affect their terms and conditions of service reach them only after being taken by management. The academic staff strongly feel that the system deprives them of the right to be consulted, and this is further exacerbated by the absence of an academic staff association.[145]

Despite the fact of being state-controlled, supervised and managed, the tertiary institutions have been able to be accountable for their efforts and outcomes through the supply of the right mix of high quality, high and middle-level manpower that is required for Singapore's economic success. The quality of the graduates is comparable with standards of any British university and well above most institutions in the Southeast Asian region. However, one wonders whether the pursuit of excellence in research that the universities are striving for to enhance Singapore's international competitiveness can be a reality if scholars are not provided with the academic freedom and privileges that are consistent with knowledge, creativity and academic excellence.

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[143] Frank Newman, *Choosing Quality: Reducing Conflict between the State and the University.* (Denver: Education Commission of the State, 1987), p. 70.

[144] National University of Singapore Student's Union, 1980, p. 30.

[145] In May 1980, the Academic Staff Association was dismantled by the Government.

8

Finance

Public Subsidy

In line with the critical importance of human resources to its long-term development, Singapore has singled out education as a major line item in its public expenditure program. In 1985, Singapore's total expenditure on education reached a peak of 5.1 percent of the Gross Domestic Product (GDP). This declined to 4.4 percent in 1987 and 3.9 per cent in 1989. However, the intention is to raise this to 6 percent of GDP, the level of expenditure in Japan.[146]

Education is heavily subsidized and tertiary education receives a substantial proportion of the education budget. Each public funded tertiary institution is annually allocated a lump sum grant which comprises of a budget for recurrent and development expenditure. The grant for recurrent expenditure is based on student numbers and the grant for development expenditure is based on capital investment outlays and is excluded from the student and institutional recurrent expenditure. The budget for the ensuing year is negotiated on a line item basis in September of each year initially between each of the tertiary institutions and the Ministries of Education and Finance. Each detailed line item could be approved, modified or disallowed by the bureaucracy. The budgets are then presented to Parliament in the following March for approval before they come into operation for the fiscal year on April 1. The institutions have the freedom to spend only the main line items of their budgets. Internal adjustments through virements are allowed between the subheads of the budget's line items. Supplementary budgets are awarded to the institutions only if the annual approved budget falls short of the operating expenditure due to unforeseen circumstances or an unanticipated new program is to be implemented during the course of the fiscal year.

As student numbers and costs rose, a steadily increasing portion of the total education expenditure was allocated to tertiary education (Figure 6 and 7). It rose from 13 percent of the education budget in 1970 to 16 percent in 1980 and 26 percent in 1990 (Figure 5, 9 and 10).

Average expenditure per student in 1985 constant prices increased between 1960 and 1970 at 9 percent per year, between 1971 to 1980 at 0.4 percent per year and between 1981 and 1990 at 9.8 percent per year (Figure 11). The average expenditure per student sharply accelerated from 1980 and peaked in the early 1980s. Thereafter it declined, indicating the Government's cut back on subsidies for higher education and the move towards greater cost-recovery. In particular, to sustain and enhance quality, there have been sharp increases in the share going to teaching and library materials and research and general maintenance and services.[147]

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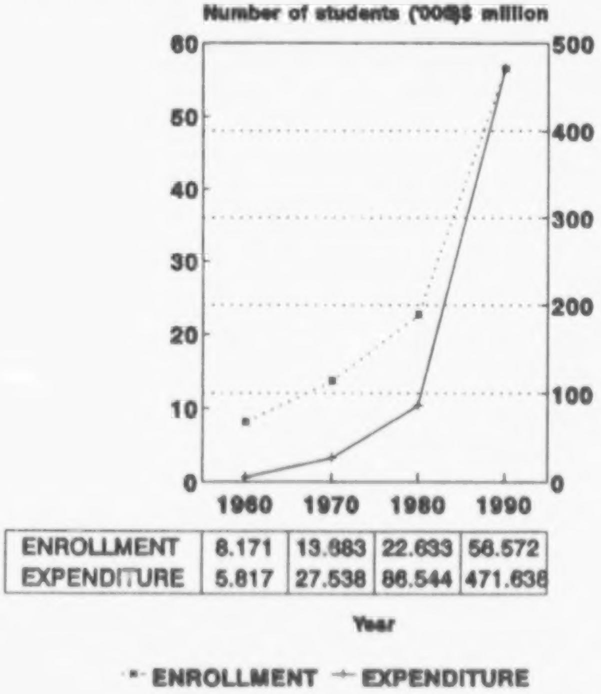
[146] *The Straits Times*, January 30, 1986.

In other words, growth was matched by more than an adequate financial support in order not to allow quality to suffer. The contention is that the State has to pay top dollars for top quality education and skills to enhance productivity, cost-effectiveness and international competitiveness and eventual cost-reduction and efficiency in higher education. By contrast, in many developing countries expansion has been accompanied by a decline in resource allocation (in unit terms), leading to a marked decline in quality, high drop-out rates and wastage of scarce resources. In many of these countries, poor quality higher education is seen to be closely linked to poor economic performance. In addition, till the late 1970s tuition fees were kept low, in order to promote equality of opportunity as well as a financial incentive to attract talent into higher education, particularly into economically critical fields of study.

Figure 6. Trends in Higher Education Enrollment and Expenditure, 1960-90



	1960	1970	1980	1990
ENROLLMENT	8.171	13.883	22.633	56.572
EXPENDITURE	5.817	27.538	86.544	471.638

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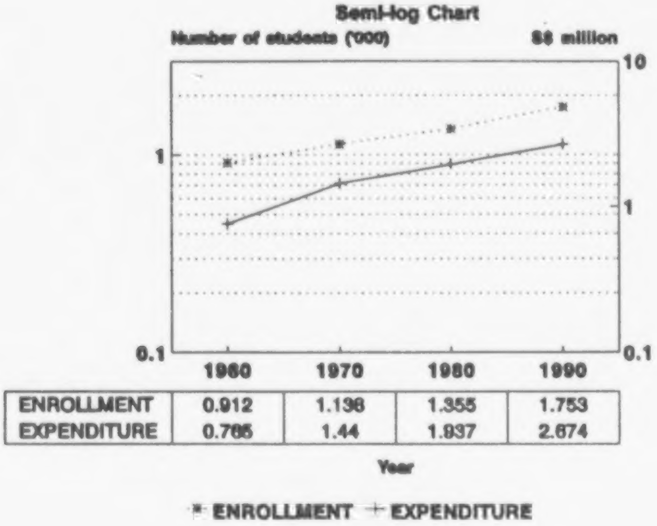
[147] Mukul Asher, *Financing the Development of Higher Education in Singapore*, (Singapore: the Regional Institute of Higher Education and Development, 1984), p. 20.

Figure 7. Trends in Higher Education Enrollment and Expenditure, 1960-90



	1960	1970	1980	1990
ENROLLMENT	0.912	1.138	1.355	1.753
EXPENDITURE	0.765	1.44	1.937	2.674

Figure 8. Share of Total Education Expenditure by Level, 1970

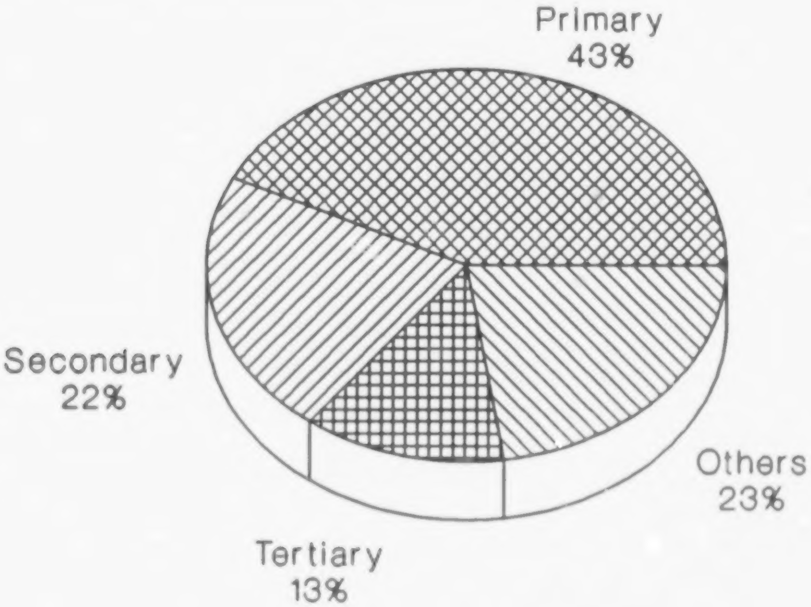


Figure 9. Share of Total Education Expenditure by Level, 1980

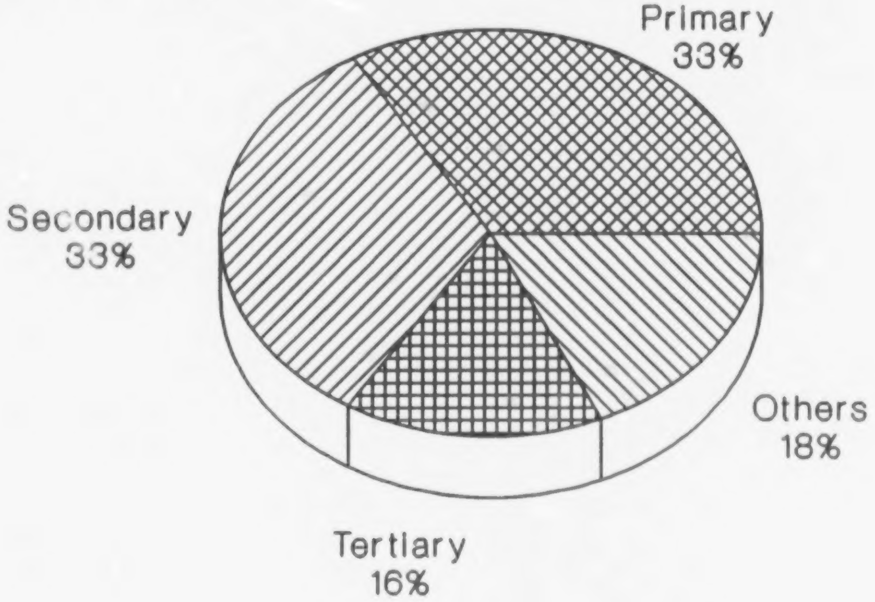


Figure 10. Share of Total Education Expenditure by Level, 1990

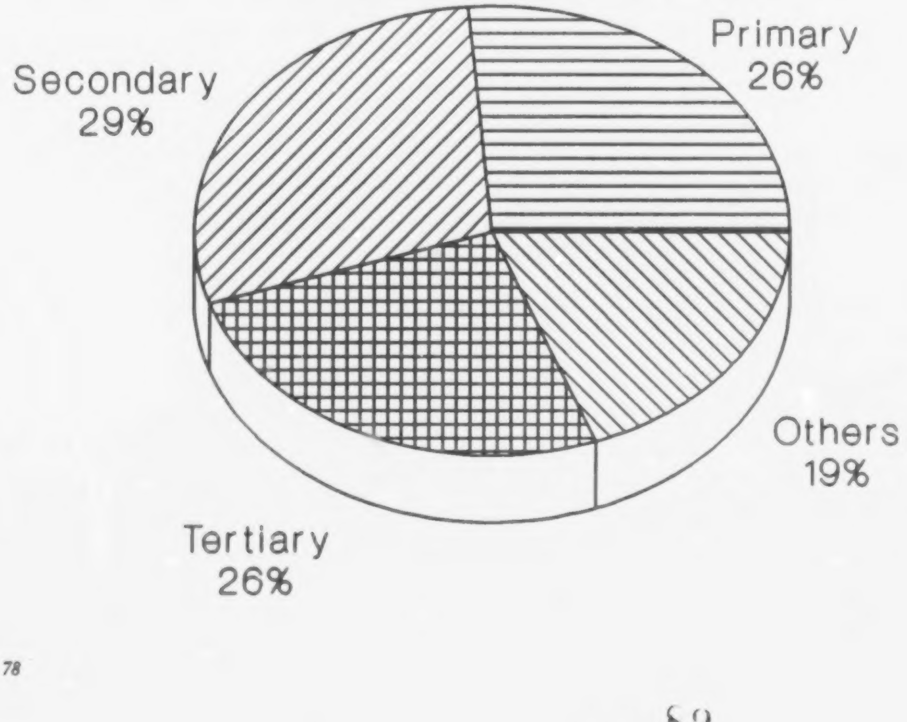
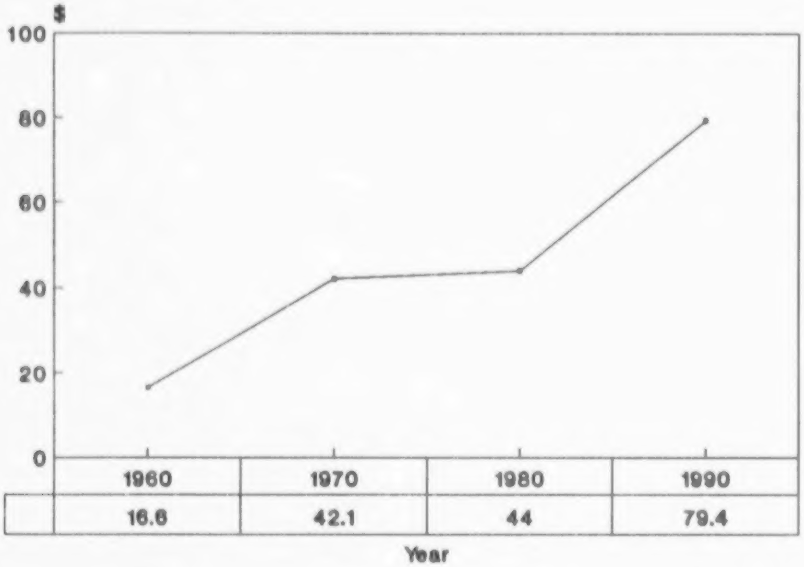


Figure 11. Average Expenditure per Student in Higher Education Per Year (at constant 1985 prices)

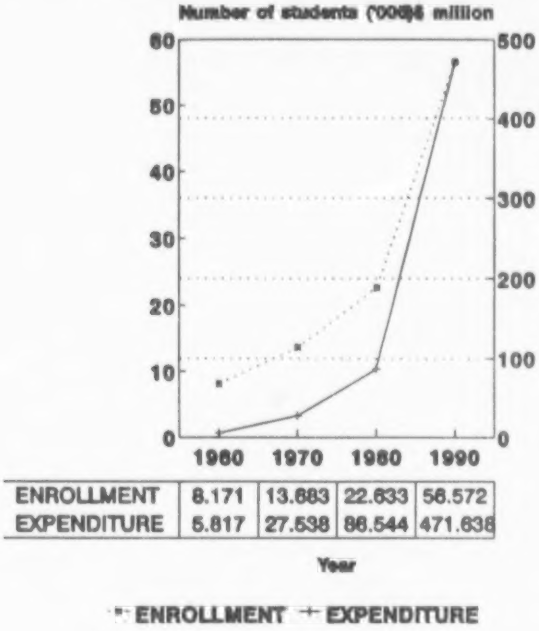


Student participation in higher education is quite widespread throughout Singapore's neighboring nine Asian countries (Figure 12). In 1990, the average gross enrollment ratio ranged from 1.7 percent in China to 37.7 percent in Korea. In comparison to these Asian countries, Singapore's relatively low enrollment ratio thus far is a reflection of *its highly selective admission policy and the country's commitment to quality and avoidance of a pool of unemployed graduates.* The achievement of Singapore is all the more remarkable when the level of government spending on higher education is compared. Expressed as a percentage of the GNP, it is highest among the nine countries (Figure 12 and 13).

In the mid-1980s, the Government's direct subvention constituted almost 90 percent of the operating cost of the tertiary institutions. After the recession of 1985-86, *the Government's policy was to shift towards financial stringency and particularly to lower its budgetary contribution to the ever rising cost of social services. This policy was translated by shifting the burden more and more towards the beneficiaries of social services.* This meant greater financial sacrifices for many families.

The tertiary education institutions too were compelled to diversify their portfolios of revenue sources in order to reduce their overwhelming dependence on Government funding. The policy is to enlist the support of individuals, educational institutions, their alumni and the private sector to share the burden of paying for a better system of higher education. Perhaps this policy has been prompted by two factors. First, after years of shortfall of graduate output, the output of graduates has greatly increased and continues to be in great demand. Second, the level of average income of Singaporeans has risen, nearly ten-fold between 1960 and 1990 and therefore, the affordability of an average Singaporean middle-class family to pay for their children's education has been strengthened.

Figure 12. Higher Education Enrollment Ratio, Private Share, and Public Expenditure Share by GNP in Nine Asian Counties, 1990



	1960	1970	1980	1990
ENROLLMENT	8.171	13.683	22.633	56.572
EXPENDITURE	5.817	27.538	86.544	471.638

The Government initiative to raise fees was supported by a group of academics who pointed out that:

> ... on both equity and efficiency criteria, it is desirable to rationalize the degree of subsidy for university undergraduates. We therefore recommend that university tuition fees should be raised provided that loans at a low rate of interest are made available to all students regardless of family financial status.[148]

The policy is to lower student subsidy, reduce the over-dependence of tertiary institutions on Government funding and base future funding on the average cost of academic activities in each department and school. The ultimate aim is to provide each institution with only 60 percent of their operating budget instead of the current 74 percent. This will hopefully lead them towards greater autonomy, flexibility and accountability.

Fees, User Charges, and Endowments

Since 1986, tertiary institutions have been progressively moving towards a broader diversification of revenue sources, particularly greater cost-recovery by revising over a period of time student fees and other user charges by significant margins. The fees were increased gradually from 1986 to 1992. However, from 1992 onwards, the increase is to be annual between 5 to 7 percent. The policy was to keep tuition fees in pace with wage and other cost increases and at about 20 percent of each of the university's operating costs.[149] However, the Government's long-term strategy is for cost-recovery to be 25 percent of the universities' operating cost.[150] Tertiary institutions have also been establishing endowment funds by tapping non-government sources in addition to government funds.

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[148] Lim Chong Yah, et al., *Policy Options for Singapore*, (Singapore: McGraw Hill Book Co., 1988), p. 152.

Student fees are divided into fees payable by the student and a fee subsidy by the Government. Foreign students from the ASEAN region pay 50 percent more than home students while other foreign students pay double of what a home student pays. Fees vary according to the institution and the course a student pursues (Table 13). Students who are in high unit-cost laboratory based courses pay higher fees but also receive a larger Government subsidy (Table 13). The fees for medicine and dentistry are more than three times of those for arts and social sciences.

Subsidies for university courses vary between 78.7 percent for Arts and Social Sciences to 79.8 percent for Medicine and Dentistry (Table 13). Subsidies to students are given in the form of grants directly to the institutions by the Government. The rationale for reducing large subsidies for the universities was to free resources for a fairer allocation of funds to students at different levels of the education ladder. The Government stand is that :

(a) the expenditure on higher education was disproportionate to expenditure on 'other' levels of education. Currently the 23,000 university students who make up about 5 percent of the student population, consume 20 percent of the education budget; and

(b) there was an undue burden on the taxpayers, particularly when private (future) returns to higher education graduates were higher and hence were most inequitable. Therefore, students should bear a 20 to 25 percent share of the operating budget of each of the institutions.[151]

The two universities have launched a $1 billion Universities Endowment Fund.[152] To give a boost to the Fund, the Government has contributed $500 million and has committed itself to match up to another $250 million, the amount that the two universities must raise from non-government sources within the next five years. The income generated from the fund would be used to support special and innovative projects as well as develop programs which will nurture intellectual curiosity and research. This will enable the two universities to contribute to the growth and development of Singapore and attain international renown as centers of academic excellence.

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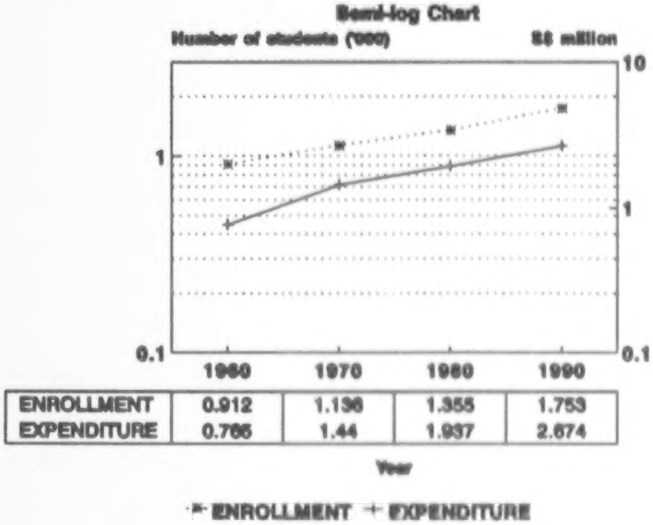
[149] *The Straits Times*, May 15, 1992.

[150] *The Straits Times*, May 21, 1992 and January 5, 1993.

[151] Ibid.

[152] *The Straits Times*, October 9, 1991, p. 1. and October 14, 1991, (Leader), p. 28.

Figure 13. Enrollment Ratio and Public Expenditures on Higher Education/GNP, Singapore, 1990



	1960	1970	1980	1990
ENROLLMENT	0.912	1.136	1.355	1.753
EXPENDITURE	0.766	1.44	1.937	2.674

Student Loans

Various loans are available to financially needy students entering NUS/NTU as well as to those who are already studying in one of these institutions. The most liberal of these loans is administered by the PSC and is available only to Singaporeans. The PSC loans are interest free and the borrower is not bonded to serve the Government. However, the marketability of the program of study is a crucial pre-requisite for the award.

The loan varies from $3,300 to $12,300 per annum, depending on the program of study and the student's financial need. The annual renewal of the loan is not automatic, but is subject to satisfactory academic performance. The borrower has to begin repayment of his or her loan 6 months after graduation or upon being employed, whichever comes earlier, and the repayment must be completed within three years.[153]

At the level of the university, a Student Loan Fund (SLF) for needy students has been in operation for some time. The loan is interest free, administered by the universities and repayable over a period of up to five years after graduation. Polytechnics too have a interest free loan fund for needy students. This loan is repayable over a period of two years after graduation.

However, when tuition fees were substantially increased in 1989, it was found that SLF was able to finance only students who were in dire need. This resulted in some consternation and concern among the student fraternity, parents and even parliamentarians.[154] There was an outcry in certain sections that higher education was being priced out of the reach of the lower-income sections of the population. In an attempt to solve this growing discontent and outcry, the Government responded with a new student loan scheme to reduce the immediate financial hardship to students and their families.

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[153] Public Service Commission, *Scholarships Bursaries Study Loans 1992*. (Singapore, 1991), p. 71-2.

[154] G. Shantakumar, "Student Loans for Higher Education in Singapore: Some Observations," *Higher Education*, Vol. 23(4), June 1992, p. 415.

The student loan scheme, known as the Tuition Loan Scheme (TLS), was introduced in 1989 by the Universities through Government aid to ensure that no deserving student is deprived of tertiary education because of the lack of financial resources. Under the scheme, the Government has established a S$100 million revolving fund for university students, and a S$5 million revolving fund for polytechnic students.

Table 13. NUS/NTI/NTU Tuition Fees and Subsidy Shares, 1980-81 to 1991-92

Course	*1980-81*		*1986-87*		*1987-89*		*1989-91*		*1991-92*		*1992-93*	
Non-Laboratory Based												
Business Administration	2.2	83.8	6.8	82.4	12.9	84.5	13.3	80.5	14.2	75.4	16.8	79.1
Arts and Social Sciences	4.8	83.3	11.8	89.8	12.9	84.5	13.3	80.5	14.2	75.4	16.8	78.7
Law	9.9	79.5	10.8	88.9	12.9	84.5	13.3	80.5	14.2	75.4	16.8	79.1
Laboratory Based												
Science	7.5	89.3	14.0	91.5	15.7	84.7	16.8	81.5	17.3	79.2	20.8	79.0
Architecture Building	6.1	86.9	12.3	90.2	15.7	84.7	16.8	81.5	17.3	79.2	20.8	79.0
Engineering	6.8	88.2	13.5	91.1	15.7	84.7	16.8	81.5	17.3	79.2	20.8	79.0
Medical	20.3	95.6	38.0	96.6	41.8	90.7	47.3	84.8	50.9	78.8	53.5	79.8
Dental	12.4	56.7	23.9	94.6	41.8	90.7	47.3	84.8	50.9	78.8	53.5	79.8

Notes: Fee = Tuition Fee (S$100.00)
S = Government Subsidy percentage of Tuition Fee

Source: G. Shantakumar, "Student Loans for Higher Education in Singapore: Some Observations," *Higher Education*, June 1992, and NUS.

All students (Singaporeans and foreigners) who are enrolled in a full-time undergraduate program in NUS/NTU can borrow up to 65 percent of their fees. Students in the polytechnics can borrow up to 50 percent of their fees. The interest charged on the loans is the average of the prevailing prime interest rates charged by Singapore's four big banks at the time of graduation. This is below that of the market rate, and the loan is interest free during the period of study. One guarantor aged between 21 and 60 years is required. To enable students to borrow with ease, no income qualification has been stipulated and non-Singaporean guarantors are accepted for foreign students.

However, in order to be eligible for continued loan installments, students must achieve satisfactory grades in their course work. Loans have to be repaid within a period of 20 years, and payment must start not later than two years after graduation. Polytechnic students have to start repaying their loans one year after graduation or a year after National Service. They have to make a minimum payment of S$100 a month over a 10 year period. If a student emigrates, the loan must be discharged before departure. If the student leaves the program without completing the course of study, the outstanding loan becomes immediately due and payable.

It is too early to assess the social and financial implications of TLS in terms of:

(a) Government's policy objective to shift the burden of sharing the cost to the beneficiaries.

(b) Amount of hidden subsidy on loans.

(c) Administrative cost.

(d) Anticipated impact of debt burdens on the students' educational career and personal decision.

(e) Loan defaults, due to the borrowers' ability to repay their obligations once they complete their studies.

In Singapore, defaults and evasion may not be major problems. The Republic's smallness, efficient bureaucracy and law enforcement mechanism would enable it in all probability to track and recover from defaulters.

Since 1989, the Central Provident Fund Act has been amended to allow parents and siblings of students under the Central Provident Fund Approved Education Scheme to withdraw their savings to pay for dependents enrolled in local higher education institutions. However, this can be done only if their accounts exceed $30,000.

There is concern in certain circles that this scheme may erode old-age savings, particularly in the event of an unanticipated inflationary spiral because of the growing decline in filial piety among Singapore's youth (in spite of the Government's inculcation in youth of the value of the family and of placing group interest above individual interest).[155]

The long-term implications of the student loan scheme and Central Provident Fund approved education scheme call for new mechanisms for financing higher education. For example, an income-contingent repayment scheme, in which the repayment of student loans is based on the incomes of the borrowers once they complete their education and begin to work, may be an alternative mechanism to be considered.

Scholarships and Bursaries

The PSC awards local merit scholarships and bursaries. These awards are for a wide spectrum of undergraduate programs relevant to the needs of the public service tenable in NUS and NTU. Like the overseas merit scholarships, these awards too are highly competitive and are offered to students with high academic promise and leadership potential. In addition, a large number of merit scholarships and bursaries are awarded for undergraduate programs in NUS and NTU, to candidates who would make teaching their career.

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[155] *The Report on Moral Education (1979)*, (also known as the Ong Report).

9

The Future of Higher Education in Singapore

The challenge facing Singapore is to nurture and reinforce key human resource capabilities to meet the requirements of the vision set for Singapore:

> ... to attain the status and characteristics of a first league developed country within the next 30 to 40 years.[156]

With this vision as a target, the strategic thrust chosen, among other things, is to enhance human resources through an increase in the supply of the top echelon of talented and professional people and to adopt an education and training program that has a life-cycle perspective for the individual, from youth to retirement.[157] Therefore, for the future, Singapore's objective for tertiary institutions is three-fold:

(a) To keep them abreast of the growing internationalization of Singapore.

(b) To make them cater for a fast changing industrial structure in which workers must learn new skills and even change jobs to meet new economic demands.

(c) To maximize the opportunities for those Singaporeans yearning for a higher education.[158]

To meet these objectives, Singapore has plans for various programs for the future. Among them are: (a) to expand part-time and evening courses at the NUS and NTU; (b) to establish a third university in January 1994, a private Open University to cater mainly for mature students, through conversion of the Singapore Institute of Management (SIM); and (c) to allow foreign universities to run courses in Singapore.

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[156] The Economic Planning Committee, 1991, p. 57.

[157] Ibid.

[158] *The Sunday Times*, October 27, 1991.

Through these various options and programs, Singapore's Ministry of Education forecasts that by the end of the year 2000, 20 percent of each Primary One age cohort would make it to the universities, while 40 percent would go to the polytechnics.[159] Another 25 percent would undergo high-skill courses at the newly revamped Institute of Technical Education (ITE). Thus, 60 percent of each age cohort of between 40,000 to 45,000 secondary school graduates each year will go on to participate in tertiary education, a move towards a mass system of higher education. This is in anticipation of the fact that many jobs relying on manual labor are disappearing and in future more and more jobs will require more than high school graduation. Further, it would ensure that, in the new knowledge-based economy, talented students are not lost to higher education and society, as they were in the past.

When a third conventional university is established, the Government plans to encourage it to forge links with Japanese tertiary institutions. This is intended to complement the NUS ties with the United Kingdom and NTU links with the United States of America. In the view of the former Minister of Education, this "... will provide Singapore very valuable links to the three main economic power-houses which will predominate in the world in the coming decades." In the meantime, Singapore will concentrate on developing NTU, the Open University and the Temasek and Nanyang Polytechnics.

Singapore, in its endeavor to take higher education out of the ivory tower and make it available to all its citizens, takes a "cautious and calculated approach." The Government is singularly committed to ensuring that the current and future course offerings and student intake into tertiary institutions are relevant to the economic success of Singapore. It is also equally committed to avoiding producing too many graduates who will not fit into the industrial structure of Singapore, thus leading to a pool of unemployed graduates. In sum, the policy according to the Minister of Education is to add to the workforce

> ... qualified graduates with skills the economy is eager to absorb, not merely promote an expensive and ultimately delusive paper chase.[160]

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[159] *The Strait Times*, March 14, 1992.

[160] Ibid.

10

Implications of the Singapore Experience for Development Policy

Lessons To Be Learned

The effective policies and practices of Singapore's higher education system differ from those in many other developing countries. Over the last three decades there has been remarkable stability and consistency in leadership and, hence in policy. The underlying goal of the policy has been consistently to build a pool of highly qualified Singaporeans with the right knowledge and training to guide and be the driving force in economic development. This was achieved through prescriptive planning which spelled out in detail the size, shape and kind of higher education system the Republic would need over the long haul, what would be taught, to whom, to how many and at what cost.

This experience has implications for education policy makers in the developing countries as well as higher education experts working in donor agencies. However, the question is not one of simply exporting the Singapore higher education strategy to another developing context. The lessons from Singapore that can be useful in any higher education strategy relate to: (a) the importance of the linkages between education, the labor market and growth; (b) the admission policy and investment strategy; (c) the uncompromising pursuit of high quality; (d) staff recruitment and tenure; (e) research policies; (f) cost effectiveness in management, and (g) financing the subsector.

The Importance of Linkage between Education, Markets, and Growth

Since Singapore's economy entered into a highly competitive and technology-driven world market place, the continuous challenge for the Republic has been to keep pace with the changing technologies, markets and competitors. To meet this challenge, Singapore recognized that: (a) it had to give priority to a higher education system that could upgrade the education and skills of its people to an international level; and (b) only highly skilled and trained people could generate the ideas and innovative approaches which would allow the country to compete successfully. In other words, the vital importance of the people's high quality skills through education and training was an essential prerequisite for economic success.

With this firm conviction, the Government over the last three decades took the bold initiative to restructure and integrate the country's higher education system and orient it to respond pragmatically and effectively to the needs of the economy.

Therefore, top priority was given to a diversified and need-based higher education system. Several steps were taken to accomplish this but the major one was the yearly graduate employment survey carried out by the institutions to help the CPTE determine the appropriate and relevant number of high and middle-level manpower to invest in. The role of the CPTE as a gatekeeper, to maintain a balance between the projected demand and supply of high and middle-level manpower needs, has helped Singapore make the right investments in higher education and avoid graduate unemployment.

This has been effectively enforced by the Government's policy of implementing and quickly translating the CPTE's manpower policy measures into relevant education and training programs at the tertiary institutions. At the institutional level, the state-controlled and state-financed institutions have been micro-managed by the state to respond to changing labor market needs.

Singapore has developed a higher education strategy that is tied to its overall development goals. One of the key elements for this successful higher education system is the active role, constant support and participation of the state and the policy of the tertiary institutions to link themselves to the various sectors of the economy. The link between policy strategy and implementation was a vital ingredient to steer the higher education system and institutions to provide the right mix of graduates and related services for development.

Uncompromising Pursuit of Higher Quality

The Government, in spite of increasing political pressure from the GPC's Education members and education pressure groups within the country to review its admission policy and increase its intake into tertiary institutions, relentlessly pursued one of the most merit-based admission systems for rationing higher education opportunity for its student population. The Government strongly holds the view that "leveling up society" should not be done at the expense of pursuing excellence. Thus, the admission policy ensures higher education standards and eventual quality.

In many developed and developing countries, quality in higher education in recent years has become an increasing concern both for the government and the public. In Singapore, investment in the quality in higher education has been a top priority. The government was prepared to close down the poorly performing and low quality Nanyang University where graduates were not able to "survive the test of the market."

Quality has been continuously enhanced through an integrated strategy of: (i) merit-based student admissions; (ii) matching student numbers with adequate state support and institutional capacity; (iii) recruiting high quality staff and providing generous incentives to high performers; (iv) maintaining a high staff-student ratio with small group teaching; (v) providing staff development with particular emphasis on teaching/learning techniques and enhancing their knowledge base; (vi) implementing student and peer review of teaching; (vii) improving student learning techniques; and (viii) monitoring academic performance through an external examination system. This has enabled the tertiary institutions to avoid high drop-out rates and the waste of resources implicit in such attrition.

Staff Recruitment and Tenure

Through an international and market-oriented academic staff recruitment system, the higher education institutions have been able to respond to changing needs and provide support for new fields of education, training and research. In addition, the academic staff recruitment system and 40:60 tenure policy have contributed to the quality of the higher education institutions. They have enabled the universities, in particular: (i) to maintain a balanced turnover of academic staff, thus constantly reinvigorating their teaching and research, and (ii) to bring in new staff with fresh ideas in areas of research. This has been essential to helping Singapore keep pace with changing technology, markets and competition.

Research Priorities

The universities see research as a vital component of their pursuit of excellence. Therefore, staff are encouraged and given incentives to undertake research. In order to facilitate staff research, the universities have strengthened research facilities through high quality infrastructure and support facilities. However, in this endeavor the universities have set realistically achievable goals. The strategy is to prioritize research choices and follow a R&D policy which concentrates on areas that are beneficial to Singapore's medium and long-term economic strategy. Through liberal tax rebates, a Product Development Assistance Scheme and a Science Park, for example, cooperation between the private sector and the universities has been encouraged currently, the private sector funds about 59 percent of the R&D expenditure in Singapore.

Priority, Cost Effectiveness and Management

The planners and policy makers have devised a system of academic management based on priority, selectivity and economy in course offerings. Therefore, all academic disciplines are not offered and supported in the universities on the ground that each university must be complete in itself. For example, agriculture programs are not offered as the Singapore economy does not have an agricultural resource base. Singapore's limited demand for agricultural professionals is met through overseas training or by employing expatriates. The same is true for veterinary science professionals.

The tertiary institutions are management-oriented. In order to enhance the performance of the management and support staff, emphasis is given to in-service training to upgrade skills and competency. This is supported by the use of modern information technology to provide data on staff, students and finance and by an organizational structure that facilitates accountability and control.

Financing the Subsector

Singapore is a prosperous state and has adopted a generous funding policy to educate and train its critical high and middle-level manpower. Funding for the higher education institutions has kept pace with enrollment. However, due to a recession in 1985 and 1986, Singapore labored under a critical financial constraint. Even though the economy has since recovered and the outlook is rosy, the leadership has taken a bold step in gradually diversify the tertiary institutions' resource base by shifting a larger part of the financial burden to the beneficiaries of higher education.

In 1980, the universities were receiving about 90 percent of the operating budget. Beginning circa 1995 they will receive only 60 percent of their operating costs through government funding. The rest of the funding has to be recovered through student fees, other user charges, income from endowment funds and private sector contributions. This shift in policy was supported by the increase of the average income of Singaporean families. In real terms, the average income has risen from S$940 per month (for a six-person household) in 1973 to $2,300 per month (for a four person household) in 1990 at constant prices. This growth was 5.5 percent per year per household.[161] Therefore, the ability of the average Singaporean family to at least partially share the financial burden of their child's higher education was perceived by the state as a reality. This diversification of the source of funding will not jeopardize the quality of the institutions, even if a need arises for the government to cut, squeeze and trim the higher education budget in case of a future period of recession and a critical financial constraint.

Emerging Issues

A Market-Driven System with Central Control

Singapore's higher education institutions are under a high degree of state direction and intervention. This was appropriate for the 1960s, 1970s and 1980s when the public sector was the dominant provider and employer of the graduate of the higher education system. However, beginning in the mid-1980s and into the 1990s, the shift has been towards a private sector dominated graduate employment market. The private sector has not only become the dominant employer of Singapore's high and middle-level manpower but is also increasingly engaging in knowledge business activities such as research, consulting and training. To respond to this private sector, it is imperative that Singapore's higher education institutions have, at the institutional level, a greater degree of flexibility in decision-making and management authority. This flexibility is particularly vital. Otherwise Singapore's public funded tertiary institutions will loose out to a growing local and foreign private sector education, training and consultancy agencies which are increasingly and quickly responding to the expanding needs of the public and private sector.

This calls for a growing partnership between the private sector and the higher education institutions. In such a partnership, the focus must be increasingly on exploiting and enhancing technological opportunities and translating them into productive activities that can have a competitive edge. In this situation, decisions can no longer be imposed from the top. The best means of enhancing this partnership is through a decentralized, self-governed, market-oriented, and accountable higher education system. For this form of partnership to be effective, the action should be triggered much more at the institutional level than at the top. This will also encourage healthy competition between the two universities and the four polytechnics for students, faculty and resources through consultancy and research contracts with the private sector. In other words, Singapore has reached a stage of development, where tertiary institutions need a greater degree of institutional flexibility to enable them to respond quickly to market changes.

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[161] *The Straits Times*, January 16, 1992.

Future Affordability of Higher Education

The rise in tuition fees since 1986, though gradual, will eventually represent a substantial proportion of the monetary cost of a program the student pursues. This has given rise to public concern, largely because it will severely constrain access to the universities for some groups. In addition, tuition fees will affect a student's choice of institutions and even determine his/her future occupational choices. This will be particularly so for students from lower income and lower middle-class families. Public concern is further exarcebated by the fact that the student loan scheme covers only a fraction of the total higher education costs of a student. There is an indication that the Government did not give full thought to the interplay of price, costs, and family income of lower income and lower middle-class families before increasing fees.

Though there does not seem to be an immediate "crisis" in the affordability of higher education, families of lower income students are concerned, as the universities have indicated that tuition fees will increase annually in line with the increasing cost of education and thus increasing the cost of higher education, resulting in loans being more expensive to low-income students in the future. This might drive away from higher education talented students from underprivileged families, who would have otherwise benefited from a higher education. Therefore, cost of higher education and student loans have to be made sensitive to the cost of the program as well as to the family resources, otherwise tuition fees will take away a growing percentage of the income of lower income families. Currently, the loan scheme has a cap of 65 percent and it is not income-sensitive. Any student, irrespective of his or her family income, can borrow. However, it is difficult for poor families to obtain income-sensitive loans commensurable with tuition fees and other education expenses as education cannot be used as "collateral" for loans because banks cannot repossess education in the event of default.

A Greater Need for Continuing Education

Technological change accompanied by advancement in knowledge and skills has made "life-time jobs" shrink because knowledge depreciates steadily as time passes.[162] In the United States it is estimated that due to technology advances, today's college graduates have to make seven major job changes during their career; hence to stay competitive and be employed, they must continue to learn every year.[163] This necessitates Singapores' workforce to keep learning in order to be able to both keep their jobs and solve problems. Therefore, to enable the higher and middle-level workforce to adjust to new technological trends as quickly as possible, a greater provision of continuing education is increasingly important. This has to be a situation-related system of continuing education. This must be accompanied by coherent and flexible continuing education programs that make opportunities available to individuals to change direction, move into new fields or provide growth in their existing careers at different points of their life. Otherwise, Singapore cannot stay competitive and Singaporeans will not remain employed.

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[162] Sir Douglas Hague, *Beyond Universities: A New Republic of the Intellect - Hobart Paper 115*, (London: Institute of Economic Affairs, 1991), p. 21.

The current provision in continuing education does not appear to have kept pace with the rapid growth of and quantitative changes in the economy. This is in spite of recognition by the country's senior policy makers that a modern industrial society needs continuous skill upgrading to be competitive. For this, the country has to invest more in continuing education at the tertiary level.

In addition, Singapore's private sector does not have the capacity to upgrade its engineers and programmers to the greater levels of knowledge and skills that are needed. Only institutions of higher learning both in the public and private sector can provide this in close partnership with the public and private sector. Singapore, therefore, needs a comprehensive strategy with built-in incentives to both the public and private sector institutions, to develop a need-based continuing education system.

Female Participation

Although the male-female ratio in higher education participation has undergone a major transformation and has been bridged, women still lag behind in medicine, engineering, economics, law, and computer science. The selection and streaming process has tended to discriminate against female students, particularly in medicine. Female students tend to be segregated into fields of study associated with women's traditional roles in society (education, social work and arts and humanities). However, if Singapore wants to be more reliant on an indigenous workforce by increasing the rate of participation of the female labor force to 50 percent by 1995, then more female participation in medicine, engineering, economics, law and computer science has to be encouraged.

Streaming and Overseas Education

To have the right mix of high quality and talented high-level manpower in critical fields, the CPTE has been administratively streaming students into faculties and courses. This device is to ensure that all the talented students are not concentrated in highly lucrative and prestigious courses like medicine but instead pursue other fields like engineering and law as well.

This has resulted in a number of students being deprived of the opportunity to pursue their first choice course of study in the universities, resulting in discontent both among students and parents. However, with the shifting of the cost burden to the beneficiaries of higher education through increases in tuition fees, highly talented students will be in a stronger position to demand their course of first choice. Failure to obtain their preference of course of study will induce some of them to go overseas, the cost notwithstanding. The policy of streaming also has implications for the individual, through the loss of freedom of choice. The question to pose for the future is whether the society looses out through private frustration vis a vis national goods?

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[163] Jack E. Bowsher, "*Educating America: Lessons Learned in the Nation's Corporations*," (New York: John Wiley & Sons, Inc., 1989), p. 209.

The Government's policy of sponsoring the brightest students for education overseas plus the possible brain-drain through streaming will further deprive the local universities and their student bodies of having the best talents to interact with. This will dilute the intellectual quality and create a permanent myth that Singapore's universities are to overseas universities, inferior. Therefore, universities in Singapore may not be able to make the upward drift into world class centers of excellence which they hope to achieve by the year 2000. However, to help Singapore's universities to grow to world stature, the Government should feel less inclined to keep sponsoring more than a few students at the undergraduate level.

Academic Freedom

A country that links itself tightly and efficiently to the changing needs of the global market has to also have a sufficiently free atmosphere for research, writing and publications. Otherwise, Singapore may be depriving itself of the possibilities for serendipitous discoveries that may both enrich its economy and more importantly—enhance the difficult-to-measure, but real phenomenon called the quality of life.

11

Conclusion

Singapore's higher education success story demonstrates the capacity of a small island state with no natural, resources to develop a highly effective, publicly funded and managed higher education system. It further highlights the fact that the Government's strong and pervasive interventionist policy and implementation strategy to link the size and standards of the higher education system to the needs of the economy has helped to establish a demand-driven higher education system. The Government's involvement in shaping the system has moved the higher education system away from the hegemony of the traditional British elitist university model towards a well-structured, multi-functional and stratified labor market-driven national tertiary system that meets the diverse manpower needs of a rapidly changing economy. In other words, a national network of tertiary institutions has been developed in which each institution takes pride in its own distinctive mission and seeks to complement, as well as to compete with, others. This policy of linking the economy, the labor market and education into an integrated policy/practice strategy has underscored the importance Singapore has given to investing in high and middle-level manpower skills complemented by a continuous upgrade of the knowledge-base and training capabilities of the tertiary institutions, in order for them to keep pace with market-driven technological changes.

This success story of a coherent strategy of bridging policy and practice has important lessons not only for small nation states but also for larger countries. In particular, the Singapore model demonstrates that there is an important link between higher education and the country's successful economic development. This needs further study. The Singapore case also shows that a highly centralized and well coordinated top to bottom model of planning, projecting and implementing the education and training needs can be an effective operational strategy if well executed. This strategy has been able to produce a pool of relevant high and middle level skilled manpower. The basic philosophy underpinning this model of manpower development was that the base-level throughput of relevant middle and high-level manpower, which produces and enhances the technology driven modern industrial society, had to grow and be continuously upgraded if the country was to maintain its robust and competitive edge in the world market economy.

At the institutional level, the model illustrates that every effort was made through a management-oriented system to translate quality and standards and relevance in teaching and research in terms of performance and output. This effort has been further enhanced through fostering and maintaining international links both in teaching and research. The research capacity of the universities is rapidly growing, however, it is prioritized to be cost-effective and relevant. Thus the specialty research institutes and the faculty or school-based research centers of both universities, largely concentrate on incremental technology that is beneficial to Singapore's long-term economic strategy. There is a rapidly growing university-industry linkage, supported by the EDB and NSTB, to promote industry-driven R&D.

Almost all of the financing in the earlier developmental stages came from public funds. However, it is of importance to developing countries that during Singapore's developmental phase, the share of the budget going to higher education increased steadily, while that to primary education declined. With the rise in GNP and personal income and with increased involvement of firms in higher education there has been a move in recent years to diversify sources of financing, including increased student contribution and private sector contributions.

Singapore, through these innovative achievements, has created an effective higher education system that has joined hands with the state for a common cause i.e., to provide the relevant middle and high-level manpower that was needed to drive and maintain its global competitive edge. In other words, Singapore's strong economic performance is underpinned by the ability of its policy makers and planners to galvanize its aspiring and talented youth through a high quality and relevant education and skills training system and to make the most productive use of the highly educated and trained people effectively in the workplace. The creation of a high quality social and political environment, accompanied by a stability and consistency of policy over three decades has made possible the necessary subsector adjustments in pursuit of the crucial manpower objectives.

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Appendix

Higher Education in Pre-Independence Singapore

The Singapore and Malaysian higher education systems have a common origin.[164] Both countries were made to develop and share a single needs-based higher education system under British colonial rule.

The first tertiary institution to be established was the Straits Settlements and Federated Malay States Government Medical School in July 1905. Its objective was to train local men to meet the growing demand for Assistant Surgeons and General Practitioners among the native and immigrant population.[165] In 1921, it became known as the King Edward VII College of Medicine and by 1936 the College provided courses in dentistry and pharmacy as well.

To coincide with the centenary of the founding of Singapore, the Raffles College was established in October 1929, with public subscription and a Government grant.[166] The College offered diploma courses in arts and science subjects and catered predominantly for children of the urban English-educated middle class and the sons of the upper crust of Malay society. The graduates largely served as teachers in the growing number of English medium secondary schools. The College provided a small number of recruits for the lower echelons of the administrative ranks of the Straits Settlements and Malayan Civil Services.

During the colonial era, the middle-level manpower needs of Singapore's public sector and predominantly European-owned and managed private sector were met by the specialized colleges established by the British in Peninsula Malaysia. The Technical and Agriculture Colleges, set up in 1925 and 1931, respectively, met the needs of the public and private sectors.

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[164] K.G. Tregonning, "Tertiary Education in Malaya: Policy and Practice 1905-1962. *Journal of the Malaysian Branch of the Royal Asiatic Society*," Vol. LXIII, Part 1. pp. 1-14.

[165] C.M. Turnbull, *A History of Singapore, 1819-1975*. (Kuala Lumpur: Oxford University Press, 1977), p. 120.

[166] Philip Loh, The Beginning of Higher Education in Singapore: Raffles College 1928-1935. *Malaya in History*, Vol. 9(l), 1965, pp. 9-17.

The English medium primary and secondary school teacher needs were met through a three-year part-time teacher training scheme. For the Malay medium primary schools, the teachers were trained in the two exclusive Malay residential teacher training colleges in Peninsular Malaysia, the Sultan Idris Training College for men and the Malay Women's College for women, established in 1922 and 1935, respectively.

In 1948, the *Carr-Saunders Commission* recommended the amalgamation of the Medical and the Raffles Colleges to form the nucleus of the University of Malaya, a degree granting, English-medium, residential institution in Singapore.[167] This was a major step forward toward the provision of tertiary education, inspite of the fact it was fundamentally a transplant of a British civic university in its constitution, standards and curricula and social purpose.

The exceptionally high academic standards of both Colleges enabled the new University of Malaya to acquire degree granting status immediately, without undergoing a probationary period. Other fledgling universities planned or established at about this time in then British colonies (e.g, Sri Lanka, Nigeria, Ghana and the West Indies) were required to be constituent colleges of the University of London before becoming universities in their own right.

On October 8, 1949, the University of Malaya was founded, serving the needs of both Singapore and Malaysia for the next 10 years. It began with three faculties and 645 students (395 in Medicine, 168 in Arts and 82 in Science). Other faculties came later—Education (1950), Engineering (1955), Law (1957) and Agriculture (1960).

At the second tier, a Teacher's Training College (TTC) was established in 1950 to meet the growing demand of the rapidly expanding primary and lower secondary school system. The Singapore Polytechnic was established in 1958 with departments of Engineering, Architecture and Building, Accountancy, Nautical Studies and craft courses to provide the growing technical and vocational needs at the middle-level. The Polytechnic awarded diplomas in professional and technical courses and certificates for craft courses.

Peninsular Malaysia gained political independence on August 31, 1957. In November 1958, the governments of the then Colony of Singapore and the Federation of Malaya, in accordance with the recommendations of the *Aitken Commission*, legislated the continuation of the University of Malaya as a single university system for both states.[168]

In January 1959, an autonomous Division of the University was established in each country, each with a Principal, a Divisional Council and a Divisional Senate, while the University as a whole was administered by a Vice-Chancellor and a Central Council with a common Court and Guild of Graduates. Medicine (along with Dentistry and Pharmacy), Law, Philosophy, Social Studies and Chinese Language and Literature were offered in Singapore, while Engineering, Malay Studies, Indian

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[167] *Report of the Commission on University Education in Malaya*, (Kuala Lumpur, The Government Press, 1948).

[168] *Report of the Commission of Inquiry on the University of Malaya 1957*, (Singapore: Government Printer, 1957).

Studies and Geology were offered in Kuala Lumpur. Core courses in Arts and Sciences were offered in both places.

The cost of operating the University as a whole was met by both governments on the basis of a triennial budget agreement. However, each Division of the University had a large measure of administrative and academic autonomy, thus enabling Singapore to pursue an independent policy to meet its own requirements for high-level manpower. This arrangement was short-lived. Differences between the two countries emerged and grew much more rapidly than anticipated on questions of policy, manpower needs, funding and access. Therefore, it became both politically and economically imperative that each country have a separate national tertiary system.

Effective January 1, 1962, the Singapore Division of the University became known as the University of Singapore, while the Kuala Lumpur Division retained the original name, the University of Malaya. In spite of this split, since 1962, between 14 and 16 percent of the enrollment in Singapore's tertiary institutions has been made up of students of Malaysian nationality, particularly of Chinese ethnic origin.

The University of Malaya used English as the main medium of instruction and was, therefore, open only to those who could satisfy the examiners in the highly competitive entrance examination held in English. This requirement effectively excluded from higher education a large pool of Malay and Chinese medium school graduates in Singapore and Malaysia. Before the change of Government in China in 1949, students from the Chinese medium schools in Singapore and Malaysia had access to universities in China. This door closed in 1949.

In 1956, to meet the demand of Chinese medium school graduates in Southeast Asia for higher education, to preserve Chinese culture and to keep Chinese education independent, the members of the Chinese community of both Singapore and Malaysia launched a community-financed "Chinese university" called Nanyang University in Singapore.[109] Built on a 200 hectare site donated by the Hokkien Huay Kuan (Association), the University adopted the US system of credit hours and concentrated on less costly subjects in the humanities and social sciences and in science programs that were relatively inexpensive.

In 1959, the *Nanyang University Ordinance* was passed, giving the University the statutory status of an educational institution. However, Government financial support was not forthcoming, for the simple reason that such an institution appeared to run counter to the policy of an envisaged united Malaysian nation. The University suffered from persistent resource constraint, as it was dependent on benefactors for its recurrent annual budgets. Nanyang was also plagued with student agitation and a shortage of qualified academic staff and essential support facilities. These factors acted in concert to impair the overall quality of the institution and the relevance of its programs to national needs.

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[109] The University, popularly called Nantah, was established through a popular fund raising campaign. It had the backing of the Malayan and Singapore Chinese Chambers of Commerce, influential members of the Chinese community as well as hawkers, trishaw-riders, taxi-drivers and ordinary working-class men and women from both Malaysia and Singapore. Nantah was considered to be a regional outpost symbolizing the preservation and teaching of Chinese language and culture at the higher level.

ANNEXES

Table A-1. Singapore: Population, 1947-90
(thousand)

	Population												
	Total			*Malays*		*Chinese*		*Indians*[170]		*Others*		*Rate of Population Increase*	*Sex Ratio (Males Per 1,000 Females)*
Year	*Persons*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*	*Males*	*Females*		
Census 1947	938.2	515.0	423.2	62.3	51.5	387.4	342.1	51.7	17.3	13.6	12.3	3.3	1,217
1957	1,445.9	762.8	683.1	103.2	93.8	555.7	534.9	89.1	40.5	14.8	13.9	4.4	1,117
1970	2,074.5	1,062.1	1,012.4	158.4	153.0	796.5	783.4	87.5	57.6	19.7	18.4	2.8	1,049
1980	2,413.9	1,231.7	1,182.2	181.9	169.6	935.0	921.2	88.0	66.6	26.8	24.8	1.5	1,042
1990	2,690.1	1,360.5	1,329.6	193.3	187.3	1,049.9	1,039.5	103.2	87.8	14.1	15.1	1.7	1,023

Source: Department of Statistics, *Yearbook of Statistics* and annual issues.

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[170] From 1970, Indians include Sri Lankans (Ceylonese) who were previously classified under "Others."

Table B-1. Labor Force Trends, 1957-90

Year	*Labor Force ('000)*						*Participation Rate (%)*	*Unemployment Rate (%)*
	Total		*Employed*		*Unemployed*			
	No.	*Growth (% p.a.)*	*No.*	*Growth (% p.a.)*	*No.*	*Growth (% p.a.)*		
1957	472	-	449	-	23	-	57.0	4.9
1966	575	2.2	524	1.7	51	+9.3	55.4	8.9
1970	723	5.9	651	5.6	73	+9.4	56.5	10.1
1972	761	2.6	725	5.5	36	-29.8	59.2	4.7
1973	817	7.4	781	7.7	37	+2.8	61.5	4.5
1974	836	2.3	803	2.8	33	-10.8	57.7	3.9
1975	852	1.9	813	1.2	39	+18.2	59.7	4.6
1976	885	3.9	846	4.1	40	+2.6	58.2	4.5
1977	919	3.8	883	4.4	36	-10.0	58.5	3.9
1978	975	6.1	940	6.5	35	-2.8	60.0	3.6
1979	1,035	6.2	1,000	6.4	35	0.0	61.4	3.4
1980	1,112	7.4	1,073	7.3	39	+11.4	63.2	3.5
1981	1,146	3.1	1,113	3.7	33	-15.4	63.0	2.9
1982	1,171	2.2	1,141	2.5	30	-9.1	63.4	2.6
1983	1,206	3.0	1,168	2.4	39	+30.0	63.8	3.2
1984	1,207	0.1	1,175	0.6	33	-15.4	63.4	2.7
1985	1,204	-0.2	1,154	-1.8	50	+51.5	62.2	4.1
1986	1,229	2.1	1,149	-0.4	80	+60.0	62.3	6.5
1987	1,252	1.9	1,193	3.8	59	-26.3	62.7	4.7
1988	1,281	2.3	1,239	3.9	43	-27.1	62.9	3.3
1989	1,305	1.9	1,277	3.1	28	-34.9	63.1	2.2
1990	1,516	16.2	1,486	16.4	30	+7.1	64.9	1.3

Notes: Computed from a various census and annual labor force surveys, *Yearbook of Statistics*.

Note: Labor Force = Economically active population 15+

Table C-1. Continuing Education Enrollment in Hong Kong and Singapore, 1991-92

Institution—Hong Kong	*Enrollment*	*Institution—Singapore*	*Enrollment*
Universities		Universities	
University of Hong Kong	40,000	National University of Singapore (NUS)	1,621
The Chinese University	53,000	Nanyang Technological University (NTU)	1,253
Polytechnics		Polytechnics	
Hong Kong Polytechnic	13,000	Singapore Polytechnic	4,479
City Polytechnic	2,000	Ngee Ann Polytechnic	1,818
		Temasak Polytechnic	189
Other Institutions		Other Institutions	
Baptist College	60,000	Singapore Institute of Management	8,019
Open Learning Institute	15,000		

Source: Hong Kong data from Open Learning Institute of Hong Kong (correspondence). Singapore data from various Institutions (direct contact)

Table D-1. Singapore—Tertiary Level Enrollments for Selected Years

Institution	1960			1965			1970			1975			1980			1985			1990		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
First Tier																					
Singapore University and National University of Singapore	1,215	426	1,641	2,035	835	2,870	3,167	1,513	4,680	3,399	2.718	6,117	5,162	4,038	9,200	7,299	7,694	14,993	9,696	8,646	18,342
Percent	20	21	20	22	16	20	33	36	34	27	45	33	37	47	41	29	52	38	29	38	32
Nanyang University	1,483	378	1,861	1,559	567	2,126	1,392	918	2,310	1,373	1,056	2,429									
Percent	24	18	23	17	11	15	15	22	17	11	17	13									
Nanyang Technical Institute Nanyang Technical University																1825	253	2078	4265	2700	6965
Percent																7	2	5	13	12	12
Sub-total	2,698	804	3,502	3,594	1,402	4,996	4,559	2,431	6,990	4,772	3,774	8,546	5,162	4,038	9,200	9,124	7,947	17,071	13,961	11,346	25,307
Percent	44	39	43	39	27	35	48	58	51	38	62	46	37	47	41	36	54	43	42	49	45
Second Tier																					
Singapore Polytechnic	2,287	55	2,342	2,255	80	2,335	3,877	217	4,094	6,293	1,331	7,624	6,562	1,712	8,274	9,965	2,880	12,845	10,864	4,583	15,447
Percent	37	3	29	24	2	16	41	5	30	51	22	41	46	20	37	40	19	32	32	20	27
Ngee An College & Polytechnic	-	-	-	634	239	873	437	161	598	1,243	409	1,652	2,049	782	2,831	5,718	3,047	8,765	8,180	5,111	13,291
Percent				7	5	6	5	4	4	10	7	9	15	9	13	23	21	22	24	22	23
Temasek Polytechnic																			185	561	746
Percent																				1	21
Teachers Technical College and Institute of Education	1,125	1,202	2.327	2,804	3,440	6,244	611	1,390	2,001	141	544	685	351	1,977	2,328	216	909	1,125	347	1,284	1,631
Percent	18	58	28	30	67	43	6	33	15	1	9	4	2	23	10	1	6	3	1	6	3
College of Physical Education																52	55	107	85	65	150
Percent																	0.2	0.4	0.3	0.3	0.30.3
Sub-total	3,412	1,257	4,669	5.693	3,759	9,452	4,925	1,768	6,693	7,677	2,284	9,961	8,962	4,471	13,433	15,951	6,891	22,842	19,661	11,604	31,265
Percent	56	61	57	61	73	65	52	42	49	62	38	54	63	53	59	64	46	57	58	51	55
Total	6,110	2,061	8,171	9,287	5,161	14,448	9,484	4,199	13,683	12,449	6,058	18.507	14,124	8,509	22,633	25,075	14,838	39,913	33,622	22,950	56,572

Source: Ministry of Education.

Table E-1. Government Expenditure on Education, 1970-80, 1989-90

	1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89	1989-90
Recurrent Expenditure	503,149	589,431	712,745	983,751	1,107,126	1,272,574	1,388,341	1,277,304	1,352,570	1,461,875	1,648,384
Percent	90.2	85.6	75.6	72.4	68.7	71.9	78.2	77.9	81.8	91.1	89.2
Primary Schools	186,266	210,143	241,364	337,339	357,249	403,915	422,806	384,044	392,741	446,713	486,303
Percent	33.4	30.5	25.6	24.8	22.2	22.8	23.8	23.4	23.7	27.8	26.3
Secondary Schools & Junior Colleges	181,545	211,840	244,940	323,163	348,200	392,387	431,866	402,396	424,465	486,226	533,744
Percent	32.6	30.8	26.0	23.8	21.6	22.2	24.3	24.6	25.7	30.3	28.9
Vocational & Industrial Training Board [a]	25,000	29694	38,900	47,401	55,121	65,662	80,294	68,966	64191	72,857	79,042
Percent	4.5	4.3	4.1	3.5	3.4	3.7	4.5	4.2	3.9	4.5	4.3
Tertiary	86,544	109,662	156,118	229,057	291,795	350,167	387,240	362,829	413,560	393,315	471,638
Percent	15.5	15.9	16.6	16.9	18.1	19.8	21.8	22.1	25.0	24.5	25.5
National University of Singapore & Nanyang Technological Institute [b]	58,185	74,557	108,527	156,435	197,947	240,448	253,811	240,805	293,443	259,014	314,716
Percent	10.4	10.8	11.5	11.5	12.3	13.6	14.3	14.7	17.7	16.1	17.0
Institute of Education & College of Physical Education [c]	7,831	11,089	13,955	17,746	18,817	21,268	22,979	19,883	20,843	21,072	28,093
Percent	1.4	1.6	1.5	1.3	1.2	1.2	1.3	1.2	1.3	1.3	1.5
Polytechnics	20,516	24,004	33,623	54,876	75,018	88,436	110,434	102,125	99,255	113,212	128,810
Percent	3.7	3.5	3.6	4.0	4.7	5.0	6.2	6.2	6.0	7.1	7.0
Others [d]	23,794	28,092	31,423	46,791	54,761	60,443	66,135	59,069	57,613	62,764	77,657
Percent	4.3	4.1	3.3	3.4	3.4	3.4	3.7	3.6	3.5	3.9	4.2
Development Expenditure	54,391	98,910	229,785	374,679	504,534	497,169	387,255	361,479	301,405	142,444	200,344
Percent	9.8	14.4	24.4	27.6	31.3	28.1	21.8	22.1	18.2	8.9	10.8
Total	557,540	688,341	942,530	1,358,430	1,611,660	1,769,743	1,775,596	1,638,783	1,653,975	1,604,319	1,848,728
Percent	100	100	100	100	100	100	100	100	100	100	100

Source: Ministry of Education

Notes: a Prior to 1980/81, figures include expenditure of Adult Education Board
b From 1981/82, figures include expenditure of Nanyang Technological Institute
c From 1984/85, figures include expenditure of College of Physical Education
d Include Curriculum Development Institute of Singapore, Extra Curricular Activities Centre, Institute of Southeast Asian Studies, Science Centre Board and headquarters expenditure

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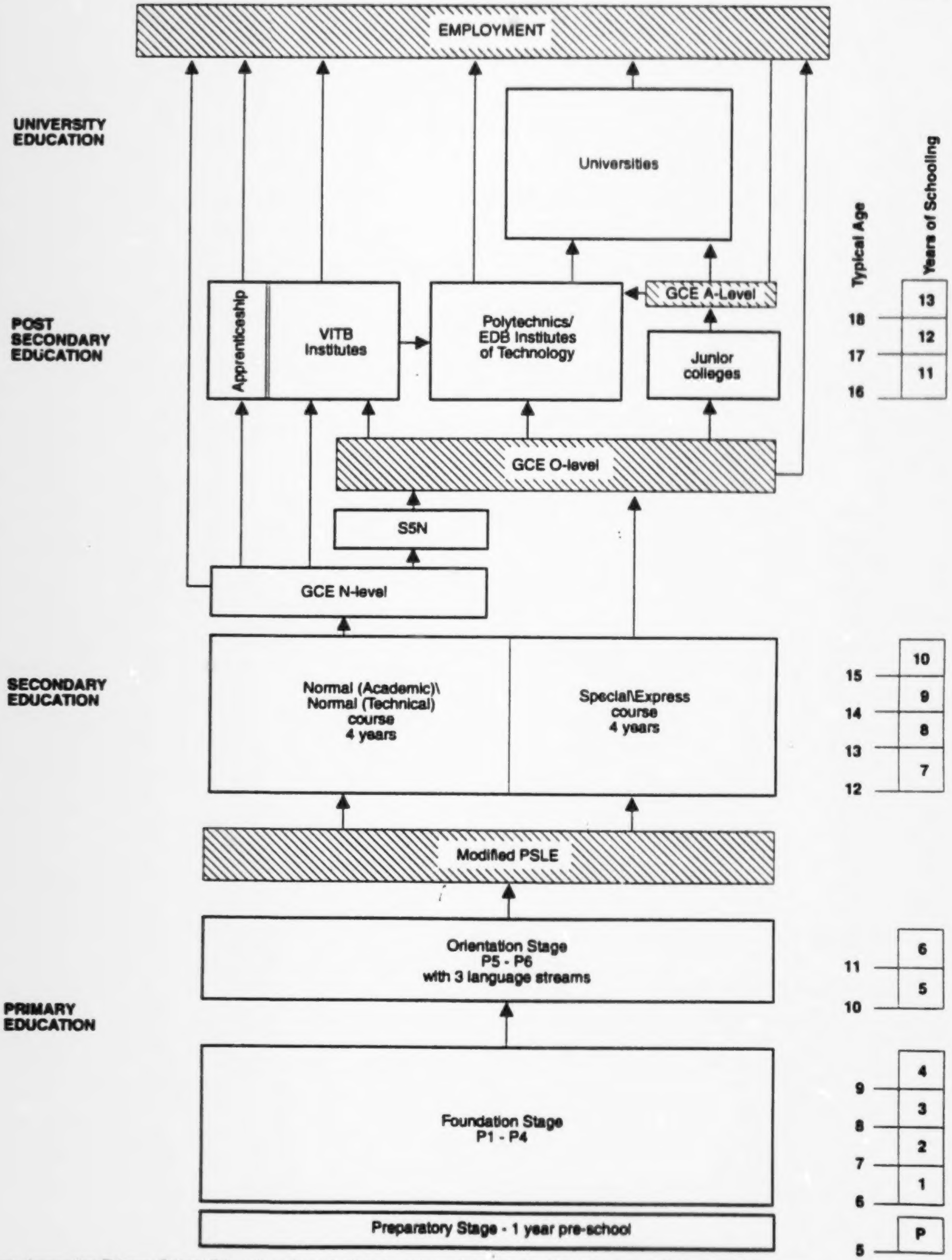
Table F-1. Scholarships and Bursaries by Country of Study, 1983-91

Country	1983	1984	1985	1986	1987	1988	1989	1990	1991
Aust	20	22	14	12	10	1	19	15	3
NZ	4	2	7	4	6	17	14	2	-
UK	31	27	40	40	34	38	56	74	75
France	4	2	5	3	6	3	2	7	3
Germany	3	-	-	3	-	-	-	-	2
Japan	13	15	14	5	11	14	8	7	12
Taiwan	4	11	5	6	6	6	-	-	1
USA	3	4	-	1	3	2	6	7	10
Others	-	-	1	-	-	-	-	-	-
Singapore	149	90	89	141	174	157	156	134	122
Total	231	173	175	215	250	238	261	246	228

Source: Public Services Commission, Singapore.

SINGAPORE EDUCATION SYSTEM

Annex 7


EMPLOYMENT
UNIVERSITY EDUCATION
Universities
Typical Age
Years of Schooling
POST SECONDARY EDUCATION
Apprenticeship
VITB Institutes
Polytechnics/ EDB Institutes of Technology
GCE A-Level
Junior colleges
GCE O-level
S5N
GCE N-level
SECONDARY EDUCATION
Normal (Academic)\ Normal (Technical) course 4 years
Special\Express course 4 years
Modified PSLE
Orientation Stage P5 - P6 with 3 language streams
PRIMARY EDUCATION
Foundation Stage P1 - P4
Preparatory Stage - 1 year pre-school
18
17
16
15
14
13
12
11
10
9
8
7
6
5
13
12
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Source: Improving Primary School Education: Report of Review Committee, March 1991, Ministry of Education, Singapore.

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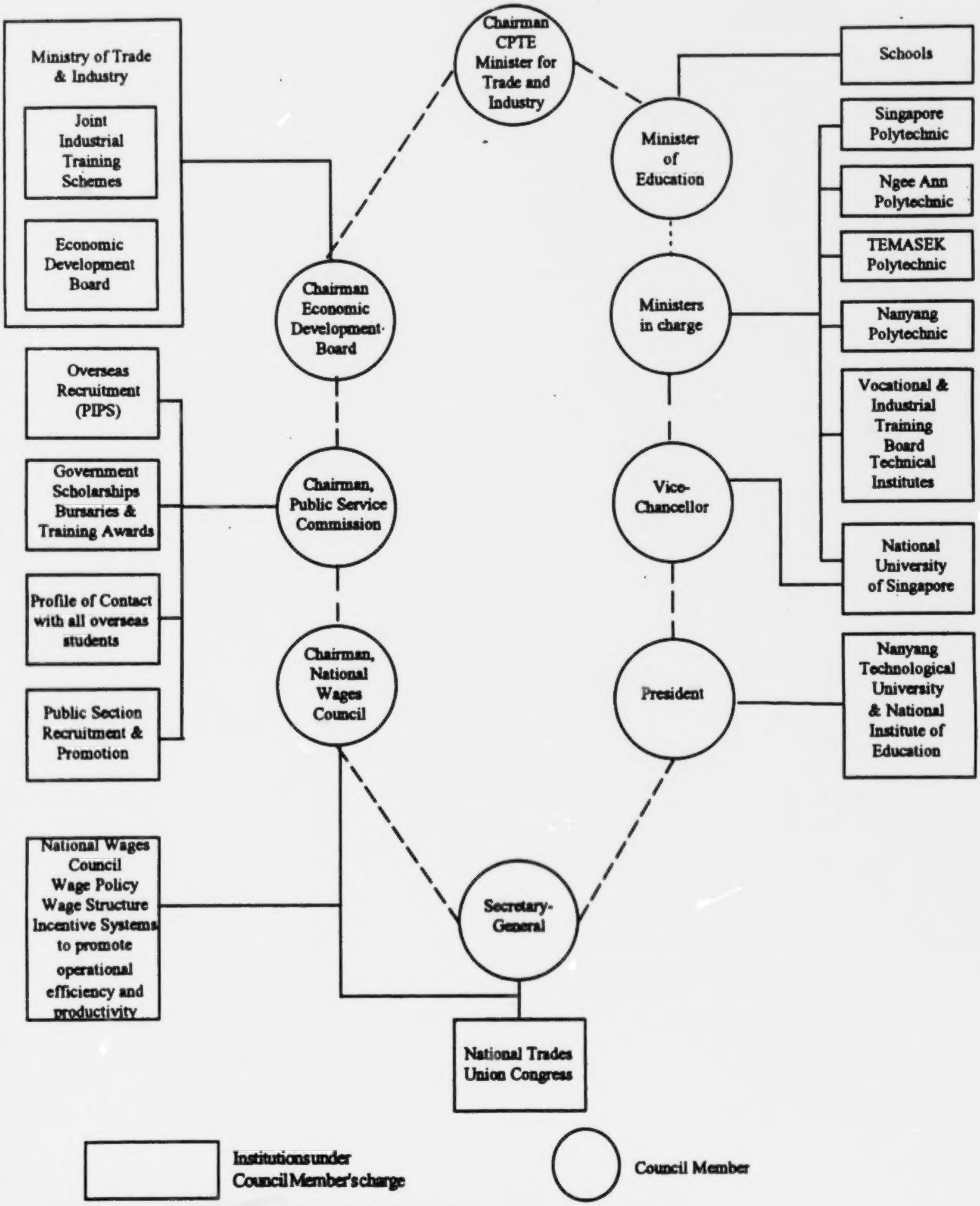
Annex 8

COMPOSITION OF COUNCIL OF PROFESSIONAL AND TECHNICAL EDUCATION, 1991


Chairman CPTE Minister for Trade and Industry
Ministry of Trade & Industry
Joint Industrial Training Schemes
Economic Development Board
Chairman Economic Development Board
Overseas Recruitment (PIPS)
Government Scholarships Bursaries & Training Awards
Profile of Contact with all overseas students
Public Section Recruitment & Promotion
Chairman, Public Service Commission
Chairman, National Wages Council
National Wages Council Wage Policy Wage Structure Incentive Systems to promote operational efficiency and productivity
Secretary-General
National Trades Union Congress
Minister of Education
Ministers in charge
Vice-Chancellor
President
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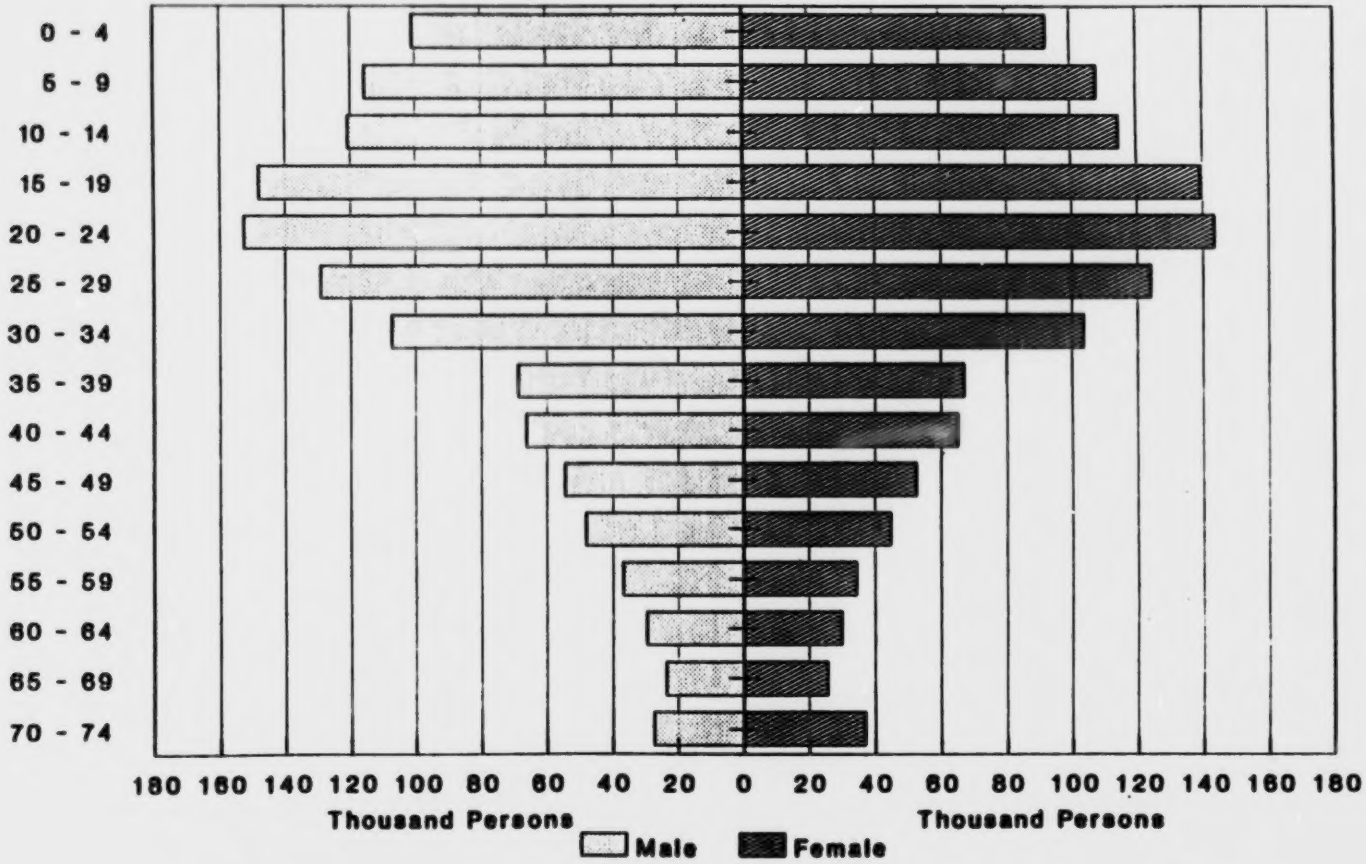
Singapore Polytechnic
Ngee Ann Polytechnic
TEMASEK Polytechnic
Nanyang Polytechnic
Vocational & Industrial Training Board Technical Institutes
National University of Singapore
Nanyang Technological University & National Institute of Education
Institutions under Council Member's charge
Council Member

Source: Linda Low, Toh Mun Heng and Soon Teck Wong (1991) and author.

Age Distribution of Resident Population, 1980 and 1990



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